

ROADS AND STREETS

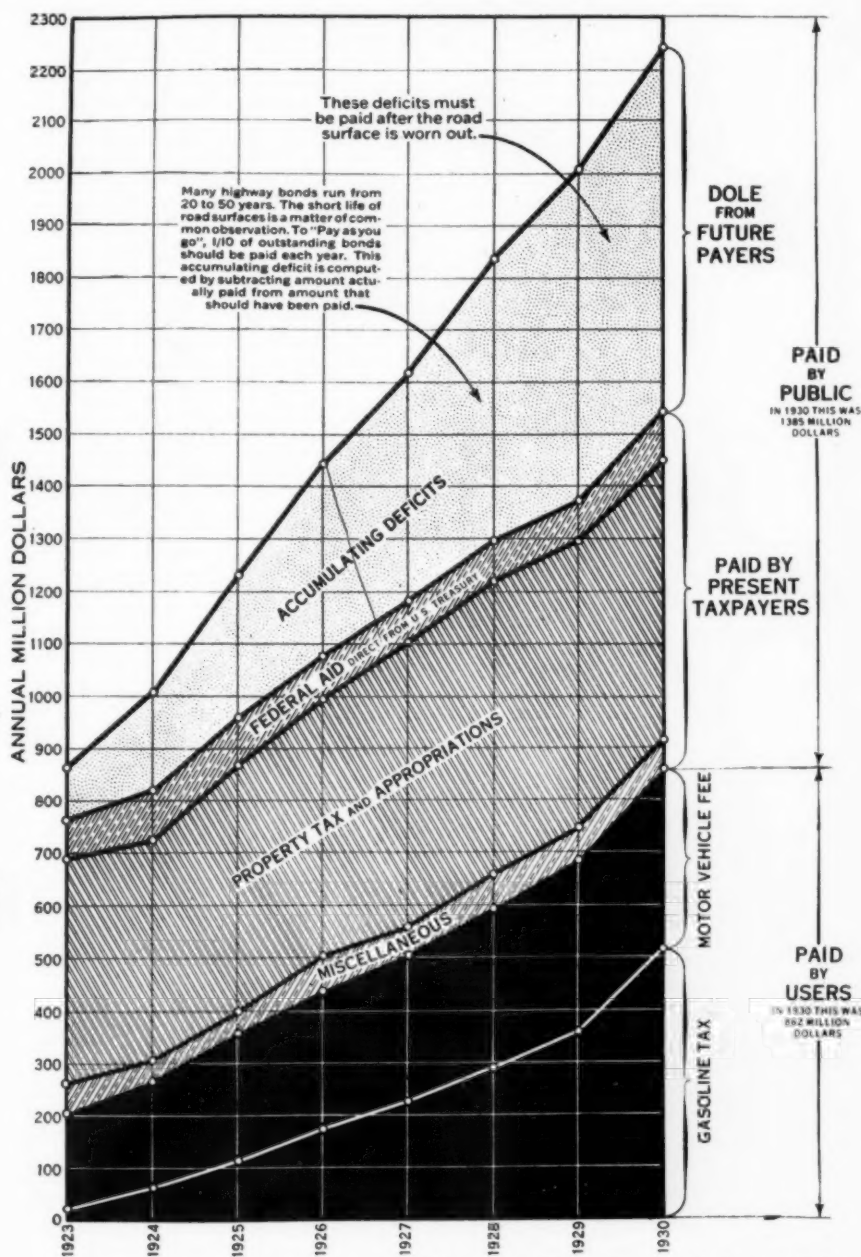
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Misleading PROPAGANDA Directed Against HIGHWAY USERS



Misleading Chart Used to Influence Public Opinion Regarding Highway Data

CERTAIN railway officials are openly conducting a publicity campaign intended to hamstring their competitors, the common carriers that use the highways. In view of this we may be pardoned for wondering whether other propaganda of the same sort may be aided by certain railways. For example, a 64-page booklet was published a few months ago, entitled "Fundamentals of Transportation Problem" by Samuel S. Wyer, consulting engineer. In this booklet the effort is made to show that neither the users of roads or canals pay adequate tolls or taxes, and that consequently the public subsidizes roads and canals. By way of contrast the rail ways are pictured as being self-supporting.

Mr. Wyer makes out a very good case as to the Erie

Canal but he is not convincing as to the Panama Canal, and he fails entirely in his effort to show that highway users are recipients of public "doles." We use his own term, "dole."

In the case of the Panama Canal he neglects to discuss its economic value from a naval point of view. It has been said that the entire cost of the Panama Canal would have been justified even if no freight had ever passed through it; for its existence makes unnecessary two fleets of American war vessels.

In the case of roads, not only does he use data incorrectly, but he introduces estimates of his own that are founded on no data, as, for example, when he estimates the life of the average road improvement as being 10

years. Grading, bridges, culverts, and surfacing are assigned by him a weighted life of only 10 years! A more erroneous estimate has seldom been printed. He bases this estimate on advice given by some unnamed persons, for he says: "In limiting highway bonds to 10 years, the Ohio State Grange advisors gave consideration to the fact that the short life road surface costs may vary from 80 per cent of the total for flat country to 55 per cent in mountainous country. The balance being in more permanent work like right of way, grading and bridges." In lieu of a depreciation, annuity he applies a 10 per cent retirement annuity to all road improvement bonds, and he fails to give any consideration to current maintenance charges, many of which are incurred in renewing road surfaces. In total expenditures for roads he includes expenditures for maintenance, apparently without realizing that he is doing so. As a result of their oversight and an absurdly low estimate of the life of the average road im-

and new construction in excess of the taxes paid by the motorists.

By this statement we infer that highway users should not be expected to pay more for use of the road than the cost of annual maintenance, annual interest on the investment regardless of financing methods, whatever operating costs are connected with highway operation, and an annuity sufficient to reconstruct the road upon termination of its economic life, assuming that highway users are to stand the entire annual cost. Furthermore, there is sufficient precedent and argument to show that public funds are not employed for the purpose of rendering a monetary return on the investment and that therefore interest on the investment in highway construction could, fairly be eliminated as a charge against the annual cost. However, for purposes of this argument we will assume that interest on the investment is included.

To determine whether the public is paying reasonable

Highway Data Incorrectly Used With Unreasonable Assumptions and Faulty Logic

provement, he arrives at an "accumulating deficit" of \$700,000,000 for the year 1930, which he labels "dole from future payers." This he adds to about \$685,000,000 "paid by present taxpayers," giving a total of \$1,385,000,000 "paid by public in 1930." (Note that less than half of this actually was paid by anybody in 1930.) To this total he adds \$862,000,000 "paid by users" of the highways in 1930 in the form of gasoline taxes and license fees. Then he tells us that in 1930 "1385 million dollars, or 60 per cent, came as a dole from taxpayers."

Not only has Mr. Wyer erred grossly in his estimate but he has erred unpardonably in his logic. His first error in logic consists in assuming that the general public is some public other than the motorists who use the roads. In European or Asiatic countries that is the case, but in America with its 125,000,000 people and 26,000,000 automobiles, there is nearly one car per family. Hence the road users are practically the entire American population. How, then, can the American public give a dole to American motorists? As well say that a man gives a dole to himself.

His second error in logic consists in regarding as a "dole" any annual expenditure for combined maintenance

rates to a public utility company, it is necessary to ascertain whether the gross annual payments are sufficient to cover operating expenses, maintenance; depreciation and a "fair return rate" on the value of the plant. Never does the amount of new capital invested during the given year enter as a factor. As an appraisal engineer Mr. Wyer should know this to be the case, yet he would have the public believe that annual taxes paid by motorists should suffice to cover all road additions and improvements during each year. In short he would apply a logical criterion to a railway and an illogical criterion to a highway, in estimating reasonableness of income from users of these two kinds of transportation plants.

Mr. Wyer is an appraisal engineer who has specialized in gas plant valuation. To write the 64-page pamphlet under discussion, he was employed by the Fuel-Power-Transportation Educational Foundation, 1116 Beggs Bldg., Columbus, Ohio, from whom copies of this pamphlet can be obtained free. "This foundation has been financed and conducted as an independent organization," they tell us. May we suggest that in future the "foundation" would do well to have the manuscripts of its proposed publications on highway matters reviewed by competent highway engineers?

Traffic Engineering at 21st Safety Congress

The 21st Annual Safety Congress to be held in Washington, D. C., from Oct. 3 to 7, will be of special interest to highway officials. It will present a varied but well balanced program of discussion and demonstration regarding important traffic engineering and accident prevention problems.

The traffic sessions will be conducted under the auspices of the National Safety Council's Street and Highway Traffic Section. Among the members of this organization are many highway departments and state highway police organizations. They include such departments and organizations in Massachusetts, Rhode Island, Connecticut, New Jersey, Pennsylvania, Delaware, South Carolina, Tennessee, Ohio, Michigan, Wisconsin, Minnesota, Missouri, Texas, Arizona, Oregon and Washington.

The sessions of the Street and Highway Traffic Section will start on Monday afternoon, Oct. 3, with a demonstration of the "Treatment of High-Accident Loca-

tions and High-Accident Drivers." A specific problem including both features will be presented and speakers will show how engineering treatment of the location will provide a part of the solution and how the correction of certain characteristics and habits of the drivers will provide another part. This session is intended to give a comprehensive picture of the traffic accident problem, both rural and urban.

The report of the Street and Highway Traffic Section's Committee on Rural Highway Hazards will be a feature of special interest at the Wednesday forenoon session.

The program of the 21st Annual Safety Congress includes a more comprehensive schedule of traffic sessions than has ever been conducted previously. The program has been the work of a widely representative committee of the Street and Highway Traffic Section of the National Safety Council, with Lewis W. McIntyre, Traffic Engineer of Pittsburgh, as chairman. Mr. McIntyre also is vice-chairman of the entire Street and Highway Traffic Section.

Labor Regulations



Promulgated

for Federal-aid Roads

New Rules Outlined to Comply With Requirements of Relief Act to Insure Maximum Employment

PROVISIONS designed to insure the maximum employment of local labor, to reduce the hours of employment and better the conditions of employment and to compel predetermination of wages to skilled and unskilled labor, in connection with contracts let for Federal-aid highway construction work under the Emergency Relief Act, are outlined in new regulations just issued by the Bureau of Public Roads.

The revised regulations were issued, the Bureau explained, to meet requirements in the relief act concerning wages, hours of employment, hiring of local labor, and preference for ward veterans with dependents.

Working of Ruling Outlined.—In an accompanying memorandum to district engineers the Bureau outlined just how the new regulations will affect the specifications for the work as to the selection of labor, insurance of the maximum employment of labor, and other factors.

The memorandum and the amendment to the road construction regulations follow in full text:

Memorandum to District Engineers: In carrying out the provisions of the Emergency Relief and Construction Act of July 21, 1932, it will be necessary to meet certain special requirements concerning rates of wages, hours of employment, employment of local labor and preference in employment to qualified ex-service men with dependents. Projects submitted under this Act will be known as "Emergency Highway Projects."

These requirements must be included in special provisions in the proposals and contracts for projects submitted under the terms of the act.

This memorandum indicates the type of required "Special Provisions," for all work done under the act. The memorandum of April 12, 1932, to district engineers on the subject of employment is not superseded by this memorandum and may still be applied to all regular Federal-aid projects.

Rules on Selection of Labor.—District engineers shall examine all advertisements for bids, proposals and contracts submitted for projects under the terms of this act to see that suitable "Special Provisions" have been included as outlined in this memorandum.

I.—Selection of Labor:

Special provisions must be inserted in the contracts designed to insure that the maximum distribution of employment be obtained, that employment be furnished to persons most in need of it, and that preference in employment be given, when they are qualified to ex-service men with dependents.

Such special provisions must call for the selection of unskilled labor by the contractor from lists furnished by special agencies, where such agencies are available. Such provision must, however, permit the contractor to obtain needed employees elsewhere when such agencies fail to function and to terminate the services of employees deemed by him to be inefficient or unsatisfactory.

Out-of-State Skilled Labor.—The use of clauses designed to forbid the employment of skilled labor not residents of the State in which the work is being done will not be approved.

The use of clauses designed to limit the employment of un-

skilled labor to residents of the State will be approved, provided such clauses permit the employment of labor not resident in the State, when a sufficient number of satisfactory laborers, residents of the State, is not found to be available.

Where the term "County Employment Committee" is used herein, other terms may be substituted to indicate other agencies such as State or Federal employment bureaus, the Red Cross or other relief organizations, as may be designated by the State.

The following types of special provisions will be required:

The contractor shall employ labor, as far as it is available, from lists furnished by the County Employment Committee, giving preference in selection from such lists, where qualified, to ex-service men with dependents.

The contractor shall inform the County Employment Committee of his needs for labor and request a list of names from which he may select his requirements. Should the committee fail to supply such lists within 48 hours after the receipt of such request, the contractor shall be free to employ any available labor, provided, however, that, when qualified, ex-service men with dependents, or other labor living in the county, adjacent counties, or in the State, shall be given preference in employment in the order named.

The contractor may employ such men as are necessary for the supervision of the construction and for the operation of power equipment requiring skilled operators without regard to such lists.

Any laborer found to be incompetent may be discharged, but it will be required that replacement be made from lists furnished by the County Employment Committee, when such lists are available.

The contractor may be released from the requirement of obtaining labor from local labor lists upon satisfactory evidence of unfair or discriminatory practices in the establishment of the local labor lists.

II.—Wages, Hours of Employment and Conditions of Employment:

Provisions must be made in the proposal fixing the minimum wages which contractors must pay to both skilled labor and unskilled labor.

Such rates must also be stated in the invitation for bids.

The minimum wages for both skilled and unskilled labor shall be fixed at an hourly rate. In fixing such minimum wages, a minimum may be fixed for each of the various classes of skilled labor, or a single minimum may be fixed to cover all classes of skilled labor. The term, "skilled labor" as used herein, shall be taken to embrace all employees other than unskilled labor, and other than those in executive, administrative and supervisory positions hereinafter defined.

These minimum wages shall be fixed by the State authority, subject to concurrence by the District Engineer, but shall not exceed the prevailing wage ordinarily existing for such labor in the locality. The District Engineer of the Bureau so far as possible will check any wage so fixed by the State for reasonable conformity with wages paid on other Federal-aid projects in the vicinity, and base his approval or disapproval of the rate thereon.

Provision must also be made in the proposal limiting the hours of work for all employees (except those in executive, administrative and supervisory positions) to not more than 30 hours in any one week. For the purpose of this memorandum, the

employees considered to occupy executive or administrative positions are the contractor, his superintendent, any timekeepers, bookkeepers, clerical employees, or other employees in a position of special trust or responsibility. For the purpose of this memorandum, the employees considered to be in supervisory positions are master mechanics, foremen or any employees whose principal duties are to direct the work of others.

Contractor Permitted to Fix Work Hours.—The provisions limiting the hours of employment per week shall be so drawn as to permit the selection by the contractor of such working hours as may be most efficient in the conduct of the work subject to the limitations of the laws of the State.

Provisions shall be made governing rates of board and similar charges. Rates of board in the proposal should be fixed with due regard to the minimum wage and the limitation of 30 hours work per week. Such rates must not be in excess of a fair charge for board.

Provision shall be made requiring the contractor to furnish the State Highway Department copies of all pay rolls, certified under oath by the contractor or his approved representative. One copy of all such pay rolls shall be transmitted by the State to the District Engineer of the Bureau.

The following types of special provisions will be required:

Skilled and unskilled laborers shall not be permitted to work more than 30 hours in any one week. The minimum wage paid to all unskilled labor employed on this contract shall be — per hour. The minimum wage paid to all skilled labor employees on this contract shall be — per hour. (If desired, the State Highway Department may use in lieu of the above provisions relating to the minimum wages the following.)

The following minimum rates of wages shall be paid all labor employed on this contract:

Unskilled labor, — per hour; oller, — per hour; power shovel operator, — per hour; truck driver, — per hour; tractor driver, — per hour; drill operator, — per hour; roller operator, — per hour; grader operator, — per hour; blacksmith, — per hour; mason, — per hour; teamster, — per hour; mixer operator, — per hour; any classification not contained herein, — per hour.

Copies of all pay rolls, certified under oath by the contractor or his authorized representative, shall be filed with the engineer, showing the name of each employee, place of legal residence, class of work, rate paid, hours worked, and the county from which the name was obtained. Deviation from this procedure will not be permitted.

Where camps are operated by the contractor, or by persons affiliated with the contractor, a charge of more than — per week (or day) for board and lodging will be considered a violation of the minimum wage specified herein. Charges in excess of a fair market price for supplies from company stores will not be permitted.

No fee of any kind shall be charged or accepted by the contractor or any of his agents from any person who obtains work on the project, nor shall any person be required to pay any fee to any other person or agency obtaining employment for him on the project.

No charge shall be made for tools used in connection with the duties performed except for loss or damage of property.

Every employee on the work covered by this contract shall lodge, board and trade where and with whom he elects, and neither the contractor nor his agents, nor his employees, shall directly or indirectly require as a condition of employment that an employee shall lodge, board or trade at a particular place or with a particular person.

Where transportation is furnished by the contractor or his agents to any person employed on the work from the point of hiring to the point where work is to be done, the charge for such transportation shall not exceed the rate charged by railroad, bus line or other public utility for similar service.

All of the above provisions shall also apply where work is to be performed by piecework, station work or by subcontract. The minimum wage shall be exclusive of equipment rental on any equipment which the worker or subcontractor may furnish in connection with his work.

III—Provisions to insure the maximum employment of human labor in carrying out the work:

Special provisions to insure the maximum employment of direct labor in preference to machine methods in certain construction details will be required to be included in all contracts awarded under this Act.

Provisions of the type shown below or others equally effective to accomplish the purpose intended will be required. The purpose as defined in the Act is to "provide the maximum employment of local labor consistent with reasonable economy of construction."

All proposals for work to be done by the States under this Act will be examined by the district engineers to see that sufficient and suitable provisions, as outlined herein, to insure "the maximum employment of local labor consistent with reasonable economy of construction," are included.

The Bureau will approve only such projects as carry sufficient and suitable "special provisions" in the contracts for the work. Approval will not be given to any procedure or requirement designed to prevent the award of contracts to qualified contractors nonresident of a State or to restrict the use of materials to those produced within a State.

The Bureau will consider "special provisions" of the character shown below, to be consistent with reasonable economy of construction. "Special provisions" of any other character than those outlined will be approved only if it is clearly shown that for the particular project the proposed provisions provide for the "maximum employment of local labor consistent with reasonable economy of construction."

Required special provisions for all work:

General.—The work covered by this contract shall be conducted in such a manner that maximum employment is afforded so far as is practicable during the life of the contract.

Clearing and grubbing.—All incidental or ordinary clearing and grubbing shall be done by hand labor, or teams or both. The use of explosives will be permitted for loosening stumps.

Grading (for all grading jobs).—All trimming of slopes in cuts and fills shall be done by hand labor. Spreading of fills, when the material contains little or no rock, shall be done by hand labor.

"Turnpike" sections may be constructed by means of power-hauled graders. Ditches, other than in turnpike sections, shall be trimmed by hand, or by the use of board scrapers. Finishing of earth road surfaces may be done by power-operated graders.

Grading (for all work of grading, subgrading and building shoulders included in the same contract with paving work).—All subgrading or fine grading between forms shall be done by hand labor methods. Fine grading of foundations to place and set forms for paving shall be done by hand labor methods. The fine grading of the subgrade to prepare it for the pavement, when no forms are used, shall be done by hand labor methods. The finishing or trimming of slopes, shoulders and ditches after the pavement is completed shall be done by hand labor methods.

Pipe and underdrains.—Trenches for pipe, tile drains and similar structures shall be dug by hand or team labor methods. The use of explosives will be permitted where necessary. Pipe shall be unloaded and placed by hand methods. The use of cranes, block and tackle, and any other equipment operated by hand or team power, will be permitted. Backfilling of excavated material shall be done by hand or team labor methods. Hand labor mixing of concrete for head walls and pipe encasement will be required.

Culverts and masonry structures and small bridges up to 50-foot span.—

All excavation and backfilling shall be done by hand tools such as picks, shovels and wheelbarrows, or by team tools, such as scrapers and carts. The use of explosives will be permitted, also power operated pumps where necessary. Where the excavated material is required to be lifted more than six (6) feet, hoists, operated by animal or manual power will be permitted.

Cement and reinforcing steel shall be unloaded by hand labor methods, may be hauled by trucks, but shall be placed by hand labor.

Aggregates shall be unloaded from cars by hand labor methods, shall be handled from the stock piles at the structure to the mixer by hand shovels, wheelbarrows, or carts, or other hand or team labor methods.

All carpenter and form work shall be done by hand labor. The use of steel forms, where allowed by the specifications, will be permitted.

Concrete shall be transported from the mixer to its place of use by carts or wheelbarrows. Chutes, where allowed in the specifications, will be permitted.

Finishing of structural concrete surfaces shall be done by hand rubbing, or other hand methods.

All other work not specifically listed above shall be done by hand labor methods in so far as is practicable.

Curbs and gutters.—Subgrading for curbs and gutters shall be done by hand labor or by team or both. Concrete and its constituent materials shall be handled as specified under culverts and small bridges.

Guard rails.—All post holes shall be dug by hand labor. Special hand tools will be permitted. Posts, where available in the quantity and quality required, shall be cut in the vicinity of the proposed work. All painting shall be done by hand labor.

Drybound and waterbound bases (macadam, gravel, limerock, caliche, etc.), and waterbound surface courses.—Initial spreading of the slag, stone or gravel shall be done by hand labor. All filler (dust, screenings, chips, sand, etc.) shall be spread by hand labor. Filler shall be broomed into the surface by hand brooms.

Surface treatments, retreads and mixed-in place types.—Spreading of cover coats by hand labor will be required. All handling of stone, slag or gravel from railroad cars to hauling equipment shall be done without the use of power equipment. Sweeping of roadway, where required, shall be done by hand brooms or by team-operated equipment.

Bituminous macadam surface course.—Sweeping and cleaning of base course in preparation to receive the surface course, where necessary, shall be done by hand labor methods. Initial spreading of coarse stone shall be done by hand labor methods. Chips shall be spread by hand labor methods. Chips may be broomed by hand labor methods.

Bituminous concrete surface course.—Sweeping and cleaning of base course in preparation to receive the surface course shall be done by hand labor methods. Premixed bituminous mixtures and natural asphalts which are delivered cold shall be unloaded from railroad cars by hand labor methods. Finishing and smoothing of surface may be done by machine methods.

Cement concrete pavements.—The use of concrete mixers in tandem will not be permitted. Curing shall be done by the earth covering method, except where the adjacent soil contains so much rock as to render it impracticable to obtain sufficient suitable covering material from the shoulders. Covering material shall be spread by hand labor methods. Removal of earth cover shall be done by hand labor methods.

Roadside production of crushed stone and gravel.—Stone shall be loaded in the quarry by hand. Where the crusher is set at approximately the same elevation as the floor of the quarry, the stone shall be transported to the crusher by hand or team methods. Where feasible, team power or hand labor will be used in gravel pits for transporting material to screening plants or loading traps. Stripping of quarries and gravel pits, where feasible, shall be done by team or hand labor methods or both.

Large bridges.—All painting of steel work shall be done by hand. Cleaning may be done by sand-blast. The use of steel forms will be permitted. As far as practicable, all other work shall be done by hand labor methods.

Optional types of special provisions.—The following types of special provisions may be used by the State Highway Department on specially selected projects, if desired:

Grading (for special grading jobs).—For grading work specially selected as being well adapted to team and hand labor methods, provisions of the following types may be used in addition to those given above under grading.

In general such jobs will be those where excavation is at the rate of not to exceed 12,000 cubic yards to the mile, or for very short jobs such as bridge approaches or minor line revisions and improvements. These provisions may also be applied to certain continuous grading sections of heavy grading projects, not less than a mile in length, where the excavation for such sections is at the rate of not to exceed 12,000 cubic yards per mile. Hand or team labor methods shall be used for excavating all earth material. Team equipment or trucks may be used for hauling excavated material. Power equipment and explosives may be used in rock excavation.

Hauling (other than excavation).—(On selected projects in locations where it is particularly desirable to provide team employment, where grades and road conditions permit the following clause may be used): Hauling of all material (other than excavation) up to a distance of 2 miles shall be by teams.

Amendment No. 6 to the Rules and Regulations of the Secretary of Agriculture for carrying out the Federal Highway Act (except the provisions thereof relative to forest roads) promulgated July 22, 1922:

Pursuant to the authority conferred upon the Secretary of Agriculture by the Act of Congress approved Nov. 9, 1921, entitled "An act to amend the act entitled 'An act to provide that the United States shall aid the States in the construction of rural post roads, and for other purposes,' approved July 11, 1916, as amended and supplemented, and for other purposes" (42 Stat. 212), known and cited as the Federal Highway Act, the rules and regulations promulgated by the Secretary of Agriculture under date of July 22, 1922, for carrying out the provisions of said Federal Highway Act, are hereby amended by revising Sections 2 and 4, Regulation 16, and by adding a new regulation, to be known and designated as Regulation 18, so that said Sections 2 and 4, Regulation 16, and said Regulation 18, shall read, respectively, as follows:

Regulation 16.—Projects through unappropriated or unreserved public lands, nontaxable Indian lands, or other Federal reservations other than forest reservations.

Section 2. Projects for construction under said Act of June 24, 1930, shall be selected and recommended jointly by the District Engineer of the Bureau of Public Roads and the State highway department.

Section 4. All provisions of Regulations 1 to 14, both inclusive, and of Regulation 18, in so far as the same may be applicable and not in conflict with this regulation, shall apply to projects hereunder.

Regulation 18.—Projects under the "Emergency Relief and Construction Act of 1932."

Section 1. The term "Emergency Construction Highway Funds," as used in this regulation, shall mean the one hundred twenty million dollars of Federal funds appropriated by the Act of July 21, 1932 (Public No. 302, 72d Congress) to be used as a temporary advance of funds to meet the States' share of the cost of work performed before July 1, 1933, on Federal-aid projects under the Federal Highway Act. All projects involving the use of such funds shall be designated "Emergency Construction Highway Projects," which shall be indicated on projects by prefixing the letter "E" to the project number.

Section 2. Emergency construction highway projects shall be initiated by the States and submitted as other Federal-aid projects, and all such projects shall be subject to all provisions of the rules and regulations, as heretofore promulgated and amended, except where the same may be in conflict or inconsistent with this regulation.

Section 3. A program of emergency construction highway projects shall be selected to meet the following conditions: A distribution of projects within the State which, measured in terms of both number and cost, shall bear a reasonably uniform relationship to the number of locally unemployed persons; a selection of types of construction that afford reasonable opportunities for employment of available unemployed persons; and the inclusion of types of construction that will permit employment through the winter months.

Section 4. Twenty-five per cent of the emergency construction highway fund shall remain unobligated until Nov. 1 in any State which shall not have established from other sources a reserve fund in at least an equivalent amount available for use for emergency highway employment purposes during the winter months.

Section 5. In the performance of work on emergency construction highway projects, no convict labor shall be directly employed.

Section 6. All contracts for the construction of emergency construction highway projects shall prescribe the minimum rates of wages, as predetermined by the State Highway Department, which contractors shall pay to skilled and unskilled labor, and such minimum rates shall be stated also in the advertisement for bids and in proposals or bids which may be submitted. The wage rates so determined may be a minimum rate for unskilled labor and a minimum rate for skilled labor, or for skilled labor a minimum rate may be fixed for each class of such labor.

Section 7. Contracts for all emergency construction highway projects shall contain stipulations that (except in executive, administrative, and supervisory positions), so far as practicable, no individual directly employed on any such project shall be permitted to work more than 30 hours per week, and that in the employment of labor preference shall be given to available ex-service men who are found to be qualified and who have dependents.

Section 8. In order to give effect to the requirement in the statute for maximum employment of local labor consistent with reasonable economy in construction, hand labor methods will be required to the extent possible without interfering with the quality of the work or unreasonably increasing its total cost.

Section 9. The specifications for each emergency construction highway project shall contain special provisions, which shall be in conformity with instructions issued by the Bureau of Public Roads, for carrying into effect the stipulations required by Sections 6, 7, and 8 of this regulation, which shall include a requirement that the contractor shall promptly furnish to the State highway department copies of each pay roll certified under oath by the contractor or his authorized representative.

Section 10. In view of the need for providing immediate employment and the advanced stage of the current construction season, projects advertised for bids prior to approval of the project statement by the Secretary, and/or prior to recommendation of approval of the plans, specifications, and estimates by the District Engineer of the Bureau of Public Roads may be submitted as emergency construction highway projects, and the Secretary may approve such projects of this nature as in his judgment merit approval, if they comply in all other respects with the law and regulations.

Section 11. Projects for which contracts were awarded prior to the date of approval of this regulation but are inoperative because of lack of State funds may be submitted as emergency construction highway projects and, if eligible in all other respects, may be approved, if in the judgment of the Secretary the facts warrant such action, subject, however, to the condition that the contracts already contain, or that the contractors voluntarily agree to incorporate therein, such stipulations as are required by Sections 6, 7 and 8 of this regulation, and subject also to such other conditions as the Secretary may impose.

Section 12. On each project involving emergency construction highway funds regular Federal-aid funds apportioned to the State under the Federal Highway Act shall be used to the maximum extent permissible by the statute; provided, that the regular Federal aid on projects in States having relatively small unobligated balances of such funds shall be in such amounts as the Secretary may approve in the project agreement for each project.

Section 13. No contract for any emergency construction highway project hereafter shall be entered into or award therefor made by any State without prior concurrence in such action by the District Engineer of the Bureau of Public Roads.

Section 14. Except as provided in Regulation 16, this regulation shall apply only to "emergency construction highway projects" as defined in section 1 hereof.

The Trend Toward Monthly Publication of Engineering and Business Periodicals

During the past few months the following periodicals have changed from bi-weekly or semi-monthly to monthly publication:

- Fire Engineering.
- Power Plant Engineering.
- Buildings and Building Management.
- National Real Estate Journal.

The following have changed from weekly to monthly publication:

- Power.
- Textile World.

The following have changed from weekly to bi-weekly publication:

- Hardware Age.
- Sales Management.

These eight periodicals are all members of the Associated Business Press. There are probably many more similar recent changes outside of the A. B. P. membership; for the depression has accelerated the general trend toward monthly publication.

Sixteen years ago the publishers of this magazine adopted the policy of monthly publication. At that time there were six construction and engineering weeklies of national circulation. Now there is only one such weekly.

Similarly, the national construction and engineering semi-monthlies and bi-weeklies have dwindled to one.

Five years ago one firm published the following 9 weeklies: Engineering and Mining Journal, Electric Railway Journal, Power, Aviation, Textile World, Coal Age, American Machinist, Electrical World, Engineering News-Record. Only the last two remain as weeklies. The first 6 have become monthlies, and the 7th a semi-monthly.

Emergency Relief Highway Allotments

The emergency highway appropriation will not only create new work to the extent of \$120,000,000, but as it will be used in lieu of state funds in matching the regular federal aid, it also will create additional new work through the releasing of federal aid allotments which some states had been unable to match. Work must be completed July 1, 1933. National forest and park roads also get \$16,000,000.

The \$120,000,000 has been allotted to the states in accordance with the regular federal aid requirements, the apportionment being as follows:

STATE ALLOTMENTS

| State | Sum Apportioned |
|----------------------|--------------------|
| Alabama | \$ 2,558,229 |
| Arizona | 1,760,771 |
| Arkansas | 2,101,182 |
| California | 4,667,188 |
| Colorado | 2,258,613 |
| Connecticut | 778,806 |
| Delaware | 600,000 |
| Florida | 1,624,752 |
| Georgia | 3,123,298 |
| Idaho | 1,505,912 |
| Illinois | 5,082,847 |
| Indiana | 3,058,980 |
| Iowa | 3,171,504 |
| Kansas | 3,265,048 |
| Kentucky | 2,264,637 |
| Louisiana | 1,745,559 |
| Maine | 1,067,079 |
| Maryland | 1,019,570 |
| Massachusetts | 1,716,612 |
| Michigan | 3,779,706 |
| Minnesota | 3,368,559 |
| Mississippi | 2,160,164 |
| Missouri | 3,753,453 |
| Montana | 2,525,071 |
| Nebraska | 2,544,773 |
| Nevada | 1,575,756 |
| New Hampshire | 600,000 |
| New Jersey | 1,657,733 |
| New Mexico | 1,965,473 |
| New York | 6,059,238 |
| North Carolina | 2,888,251 |
| North Dakota | 1,933,901 |
| Ohio | 4,490,175 |
| Oklahoma | 2,888,723 |
| Oregon | 2,001,740 |
| Pennsylvania | 5,267,060 |
| Rhode Island | 600,000 |
| South Carolina | 1,666,755 |
| South Dakota | 2,004,573 |
| Tennessee | 2,605,160 |
| Texas | 7,664,621 |
| Utah | 1,395,331 |
| Vermont | 600,000 |
| Virginia | 2,256,178 |
| Washington | 1,920,470 |
| West Virginia | 1,323,912 |
| Wisconsin | 2,991,076 |
| Wyoming | 1,541,561 |
| Hawaii | 600,000 |
| Total | \$120,000,000 |



Jan. 21, 1871

The various street alterations, picture on next page, now being made in New York City will, when completed, give it valuable outlets for commercial business. Old streets, whose narrowness has been a serious drawback, are being rapidly improved, while new routes are coming into practical existence, which will relieve Broadway, Third and Sixth avenues of much traffic.

Church street is to be still further extended by cutting a street through from Battery place to Morris street, by which both Hudson street and West Broadway will be connected with the Battery.

Then, West Broadway will connect with Sixth and Seventh avenues by the opening of a new street from the Canal street terminus.

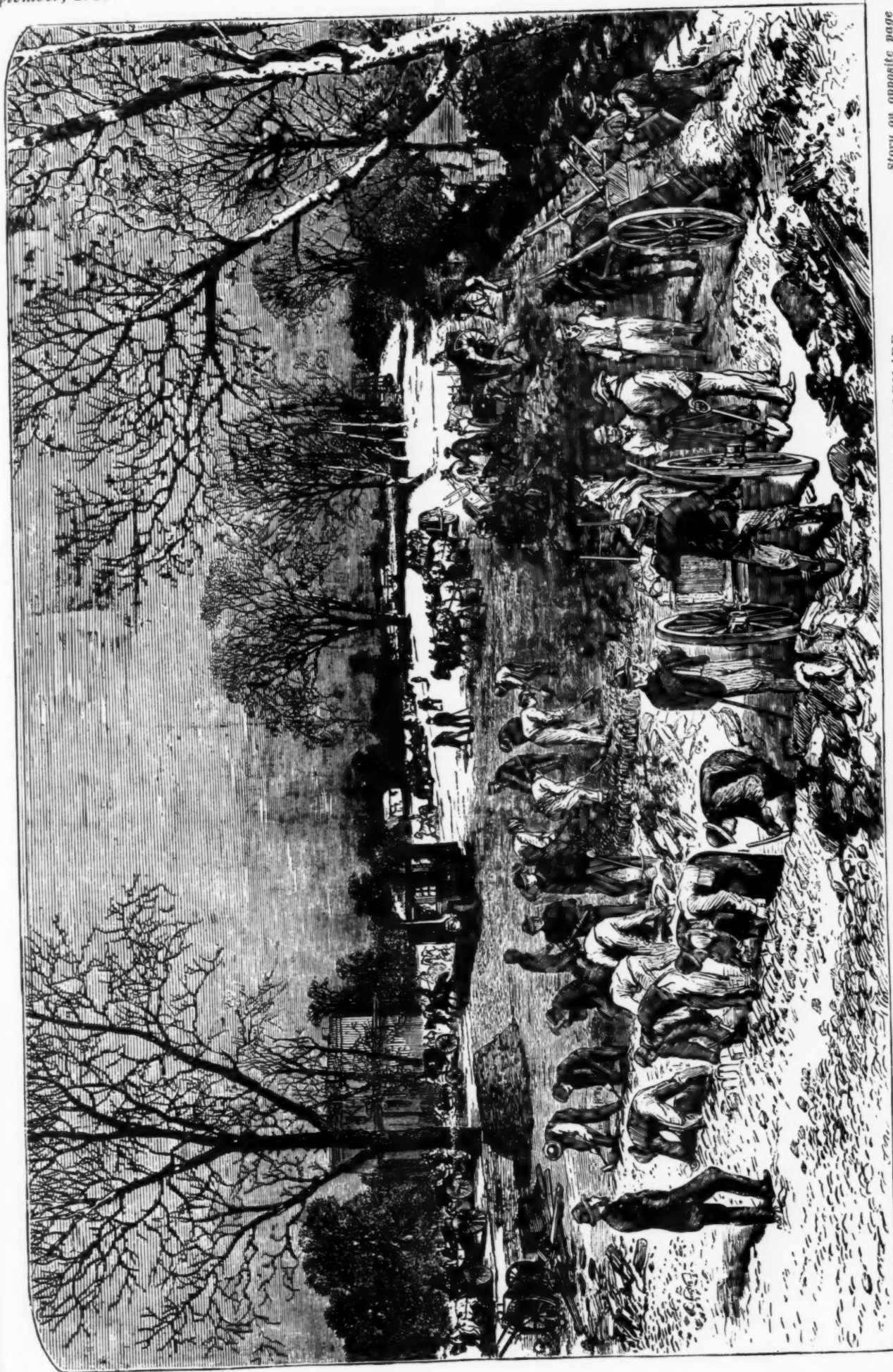
On the east side, Center street will be carried north into Crosby street, widening the latter on the south side, and thence across from Bleecker street to Lafayette place. The commodious avenue thus to be secured from the East River Bridge landing to Union square will be appropriately called Bridge avenue. In order to form a new outlet for the Bowery, it is proposed to widen Chatham street, and to provide connections with First avenue from the Square, with Second avenue and Eldridge street, and with Irving place and Lexington avenue from Tenth street. Madison avenue is to be extended from Twenty-third street to Broadway at Nineteenth street, from which point Broadway will be considerably widened to Union Square. Lexington avenue is to be opened through Gramercy Park to Irving place, and will also be extended through Hamilton Square, and on thence from Sixty-ninth street to Harlem River.

Of the great longitudinal roads or boulevards, the chief is that heretofore known as the Old Bloomingdale road, beginning at the southwest corner of Central Park, crossing Ninth avenue diagonally at Sixty-fifth street, and Tenth avenue at Seventy-second street, intersecting Eleventh avenue at One Hundred and Sixth street, and following the course of that thoroughfare to One Hundred and Fifty-seventh street. Thence departing westward, it traverses the high bluff above the Hudson to a point midway between Fort Washington and Kingsbridge, where it turns into the road of that name. This will be the Grand boulevard of the city, and will afford a direct route through the city from the Battery to Kingsbridge, a distance of fifteen miles.

The second boulevard proposed—the St. Nicholas—is a central one, beginning at the Farmer's Gate, north end of Central Park, and ultimately joining the Kingsbridge road.

The eastern boulevard also begins at the Park, and will be the continuation either of Sixth or Seventh avenue to the Central Bridge, over the Harlem River.

The work of regulating and grading these avenues has proceeded with remarkable activity, and it is expected that by summer the Grand boulevard—of which we give an illustration, together with the steam-engine used to crush the stones and harden the surface of the road—will be completed from Fifty-ninth street to One Hundred and Fifty-fifth street.



Story on opposite page

IMPROVEMENT OF BLOOMINGDALE ROAD—WORK ON THE NEW BOULEVARD

PROTECTING OUR HIGHWAY INVESTMENT

*I*N the almost universal call for reduced tax levies the taxing bodies are likely to cut indiscriminately. If this is done highway maintenance funds will suffer.

There should be a clear distinction between maintenance money and other highway funds. Maintenance funds are a kind of insurance to preserve the integrity of existing highway investments. The omission of a piece of new construction may be inconvenient, but the omission of necessary maintenance operations may result in a very great direct money loss.

A highway is necessarily subjected to disintegrating agencies of various kinds. Weather alone will cause a road surface to deteriorate even if little or no traffic uses the road, if the road is not properly maintained. Temperature changes, water, and freezing and thawing all have their effect on unprotected road surfaces. In addition, traffic crushes with its weight and tears and abrades with its fast-moving wheels. Constant maintenance is necessary to counteract these forces and to replace and repair their effects. Not only are these forces destructive of themselves, but their effect is cumulative.

Delay in construction projects is not ordinarily a serious matter. The use of the structure is lost, to be sure, but it can be built just as well at a later date. Not so with maintenance operations. They must be done when needed. Delay means more cost and much delay may mean a complete rebuilding job instead of an inexpensive minor repair.

Our enormous highway investment is endangered by the tendency to still further reduce the comparatively small maintenance funds necessary to keep the roads and streets in shape.

Adequate maintenance gives direct return to the road user by keeping the road surface in proper condition. It costs much less to operate a motor vehicle over a smooth, well maintained road than over a rough, pitted, uneven highway surface. This saving is in addition to that produced by keeping the original investment intact.

No one would want to do without roads or with less roads than we have. However, if maintenance is neglected we will have less roads because some of them will rapidly become unsatisfactory for traffic.

Funds for maintenance must be provided to protect our investment in highways and to keep our highway facilities up to their present level. Road conditions are never static. They are either becoming better or worse. Adequate maintenance may make them better, inadequate maintenance is sure to make them rapidly worse. The answer is:

Do Not Cut the Maintenance Funds

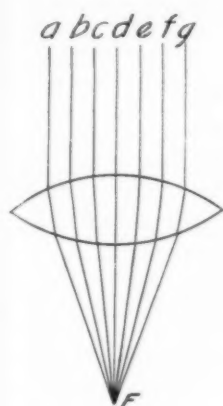


FIG. 1

Reflecting Lenses for Highway Signs

By CHESTER B. SLAWSON

Assistant Professor, University of Michigan

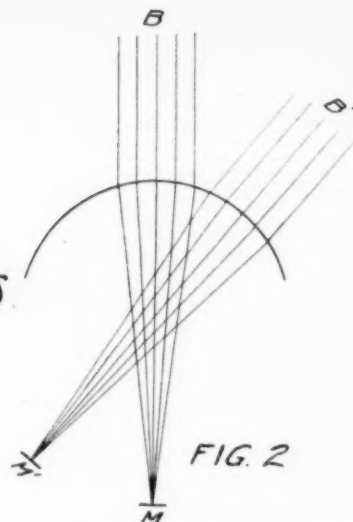


FIG. 2

ONE of the most serious hazards of night driving, the lack of proper road signs, has been greatly reduced during the last few years by the introduction of reflecting lens systems. These lens systems are circular units ranging from three-eighths of an inch to an inch in diameter. They may be arranged in such a manner that they spell out the letters of a warning sign or they may be grouped to form arrows or other insignia. When the beam from the headlights of an approaching automobile strikes the sign the lenses become luminous and each individual lens stand out as a bright disk. At a distance of three to four hundred feet the average person can read the letters distinctly. At greater distances the letters merge into one luminous blurr which is visible up to a thousand feet or more. Equipped with these lenses the standard sign becomes as distinct and legible at night as in the daytime. In fact, because of the contrast with the darkness they are brought more quickly to the driver's attention at night.

Because of the vividness with which these lenses stand out many people have wondered upon what optical principle they operate. Another question which arises is why are they visible to the occupants of the car whose headlights shine upon them and not to a person standing fif-

teen or twenty feet to the right or left of the car. It is the purpose of this article to explain the operation of these lenses in a semi-technical manner. The general optical principles will be pointed out but no attempt to treat the subject in detail will be made.

All of the various types of lenses now on the market operate upon a simple and familiar optical principle. We all know that a lens such as the one illustrated in Fig 1 will focus light at a point F known as the focus of the lens. This is the experiment of the "burning lens" that all boys try by holding a lens in the sunlight and focusing all the rays upon a piece of wood. The heat generated at this point is sufficient to ignite the wood. If a mirror at F , Fig. 1, perpendicular to the central ray d , that ray will be reflected directly back along the path by which it entered. The ray c will be reflected back along the path by which the ray e entered, and e back along the path by which c entered. Similarly, we may develop the same line of reasoning for the rays a , b , f , and g . In Fig. 2 this is illustrated by the mirror M which directs the beam of light B directly back toward its source. If the beam of light strikes the lens at an angle as B' , Fig. 2, it will also be focused at a point and a mirror M' would reflect it directly back upon itself. Now if the mirror is a

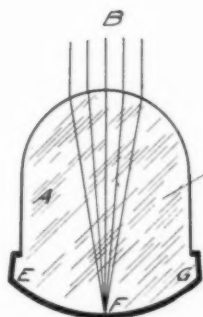
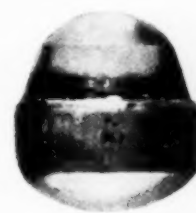
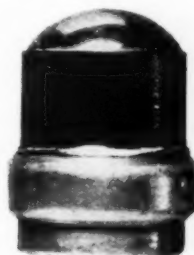


FIG. 3

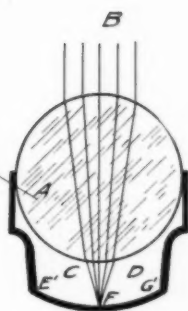


FIG. 4

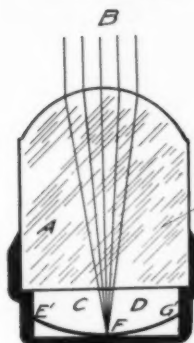


FIG. 5

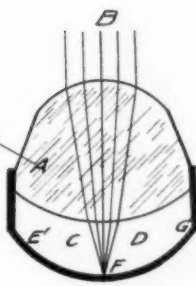


FIG. 6

curved surface as *EFG*, Fig 3, of the proper dimensions and correctly placed it will reflect all angular beams directly back towards their source. Under these conditions it makes but little difference at what angle an automobile approaches one of the signs equipped with this type of reflecting lens.

This ability to reflect rays striking at an angle is called the "angularity of the lens." It generally is measured as the angular distance between the extreme limits of reflection, although, sometimes it is spoken of as the angular distance between the normal to the lense and one of the extreme limits of reflection. Obviously the value by the second method will be half that of the first. It is possible to design a lens with an angularity of nearly 180° but such a high angularity can only be obtained with a great loss of "head on" intensity. An angularity of $80\text{--}100^\circ$ can be achieved without much sacrifice of "head-on" intensity but with anything greater than this the loss in intensity increases much more rapidly than does the angularity.

The efficiency of these reflecting lens systems is more dependent upon the rigid adherence to correct optical design than upon the visible evidences of good workmanship. By way of comparison, we all realize that the efficiency of the modern automobile is more dependent upon what is under the hood than upon the body. For example, the presence of a few small air bubbles in the glass will detract much less from the reflecting power than will a slight displacement of the reflector with respect to the lens.

In general there are two main factors in the construction of the reflecting units, first, the distance from the front lens surface to the reflector, and second the curvature of the reflector. These in turn are dependent upon the type of glass used for constructing the lens. Glass possesses the property of focusing light because of its ability to bend (refract) rays of light. Different glasses have different refractive powers which we express by a term known as the *index of refraction*. The higher the index of refraction, the closer will the reflector have to be to the lens surface. This in turn means that the radius of curvature of the reflector must be shorter. The average glass has an index of refraction of 1.52. If a lens system is designed for a glass of that index of refraction, it would be wholly unsuited for a glass lens with an index of refraction of 1.58. Consequently if reflecting units are to be made, all on the same design, but with different colored glass, these glasses must all have the same index of refraction.

Because of the expense involved it is impossible to grind the lenses, hence they are cast in molds. These molds are made of cast iron and are constructed in multiple units of twelve or more lens cavities each. The glass is forced into the molds in a thick viscous condition. The molds are maintained at a temperature close to the melting point of the glass. The molds close forcing out the excess glass, the glass cools quickly in a few seconds, the molds open, and the finished lenses drop out.

There are two distinct types of reflecting units, distinguished by the method used in incorporating the reflectors with the lens, but both of these methods follow the principles outlined in paragraph three of this article. We will speak of these two types as the *one unit* and the *two unit* systems. The one unit system is represented by Fig 3 and the two unit system by Figs. 4, 5, and 6.

In the *one unit* system the same piece of glass serves both as the lens and the reflector surface. If a piece of glass has the general shape of Fig. 3 and is so designed that the rear surface *EFG* lies at the proper distance from the front of the lens and has the proper curvature, then the curved rear surface *EFG* may be silvered and

used as the reflector. The method of silvering is the same as is used in silvering mirrors. In order to protect the silvered surface it is given a few coats of paint and may or may not be encased in a metal housing. A metal housing is necessary only for protection when the unit is to be subjected to very severe usage.

The *two unit* system consists of a glass lens and a metal reflector as separate units. The variations of this type are illustrated in Figs. 4, 5, and 6. In each figure the lens is shown by A, the metallic reflector *E'FG'* is of proper curvature for the type of lens used and is placed at the proper distance from the lens, and CD represents the air space between the lens and the reflector. There are other variations in the shape of the lenses used but these three are typical representatives of the fundamental types.

The best reflecting surface to use is metallic silver which may be deposited either chemically or electrolytically. Silver has a reflecting efficiency of 90 per cent while chromium, the next best reflector from a practical standpoint, has an efficiency of only 67 per cent. Chromium has one big advantage over silver and that is, it does not tarnish. Where silver is used the surface must be protected from the atmosphere and moisture. A silvered surface is attacked slowly by oxygen and very rapidly by sulphide fumes. In the presence of water the rate of attack is greatly accelerated.

With lenses of different diameters the intensity of the reflected beam will vary with the square of the diameters. For example, with two lenses three-fourths and seven-eighths of an inch in diameter respectively, the intensity of the reflected light would vary in the ratio of 36 to 49. This would mean that a seven-eighths inch lens would be approximately 40 per cent brighter than a three-fourths inch lens.

An interesting feature in the history of the development of these lenses is that lens systems of this type were developed over eighty years ago. The principles upon which these lens are based were developed by Fizeau in 1849 when he measured accurately, for the first time, the velocity of light. He directed a beam of light across a valley and reflected it back toward the source by a system of lenses and mirrors similar in all optical principles to the reflecting units we have been describing. By an ingenious method he measured the interval of time elapsed during the passage of the light to and from the reflector and thus calculated the velocity of light.

Have You Beaten This?

Those who are making money moving dirt these days have to move it fast. The Fredrickson & Watson Construction Company of Oakland, Calif., believe that, considering the size and weight of the machine used, they have established an output record for a dragline in sandy dirt.

The contract was the state highway job, U. S. Route 101, south of Santa Maria. In the early stages of the work the soft-going prevented the use of trucks so crawler wagons were installed. The dragline had a 40-ft. boom and a 2-yd. bucket.

The California division of highways states as follows:

"The hauls were from 300 to 1500 ft. 141,500 cu. yds. (bank measure) were moved in $73\frac{1}{4}$ shifts between Jan. 22, 1932, and Mar. 8, 1932.

"The maximum daily output for an 8-hour shift was 3200 cu. yds. The maximum hourly output was 480 cu. yds. The average output for the job was 1931 cu. yds. per 8 hours. All quantities are bank measure and not truck count."

Here is something for dirt movers to shoot at.

SELF LIQUIDATING

NATURE

of Paving

Programs



Highway Expenditures Are Proven Profitable Investments

WHILE good highways may not earn dividends which can be placed in banks, there is no question but the highways, in the light of known savings in car operating costs and maintenance costs, are numbered among the most profitable of public enterprises.

The actual cash value of a good highway cannot be measured, no more than the worth of a human life. We know that a man's capitalized annual earnings do not represent his real worth to society.

Similarly, in assigning values and earnings to a highway there is every likelihood that the expressed figures will be far short of their true worth. We know that the highway is the visible means that brings solidarity to a nation, and education, progress, ambition, and happiness to the individual. So when it is shown that good roads actually pay for themselves, it can be considered that the intangible benefits make them a bargain indeed.

During a period of enforced economy such as this, the intangibles are shoved aside; the highway must show that it will return cash dividends to reimburse its builders. That is why the well-built surface honestly deserves a place in any program which calls for the construction of self-liquidating projects.

Highway earnings must be calculated through a consideration of three important factors:

Income earned by roads through gasoline tolls (taxes) and motor vehicle license fees.

Reduced car operating costs.

Reduced maintenance costs.

Beginning with the introduction of the gasoline toll (tax) in 1919 motorists began to assume larger and larger shares of the cost of building roads so that now motorists pay nearly all state highway costs. In 1930, for example, road users, through motor license fees and gasoline tolls (taxes), paid more than 90 per cent of the total state road income from tax sources.

The gasoline toll (tax) had a very quiet beginning. The first few states that adopted it were amazed at the rapid increase in tax returns, or better, road earnings. They had not realized how good roads would stimulate travel. As the gasoline toll (tax) spread to other states and as road earnings poured in for additional new construction, not only inter-state travel but cross-country travel sped ahead by leaps and bounds.

The gasoline toll (tax) was created as a road toll which charged road users in proportion to their highway travel. Clearly, the income from the gasoline toll (tax) is as much a service fee as are water rentals or toll bridge fees. The income from the gasoline toll is as bankable as the quarters citizens drop into gas meters. States, however, are faced with road problems of such propor-

tions that they must go on placing these earnings from the roads right back into new construction so that road upkeep and car operating costs may be lowered to the further benefit of the road user.

When you drive over a dirt or gravel road or any of the inferior surfaces, you are conscious of extra gasoline consumption and tire wear; new body squeaks tell you that these roads are increasing the wear and tear on the car itself. A number of years ago T. R. Agg, now Dean of Engineering at Iowa State College, translated these items of wear and loss into actual figures. Recently his figures were revised as demanded by the changing times, conditions and automobile design. His data, based on actual car operating costs, show that for year-round travel the motorist who drives on smooth hard surfaces rather than on intermediate type road is saved one cent a mile and if he drives on these smooth hard surfaces rather than unimproved type roads the savings are two cents a mile. Savings, of course, are earnings.

There is much evidence to support the accuracy of these car operating cost savings. Recently a tire company operated a fleet of 15 vehicles over 30,000 miles of roads on a round-the-nation trip. A careful record was kept of the cost of operating on the various types of road surfaces and the savings coincided with Dean Agg's figures almost to a "T."

Apply these earnings to the average motorist and you will find that the money he spends in gasoline tolls and license fees is compensated for in a very short time. The average motorist in 1931, for example, paid nearly \$35 in license fees and gasoline tolls. He had only to drive 1,750 miles over high type pavements in order to earn this \$35 through lower car operating costs, based on the savings of two cents a mile. But if the average motorist were to travel on intermediate type surfaces instead of unimproved type he would only have to drive 3,500 miles to make up for the money spent in gas tolls and his license fees. However, the average motorist drives in the neighborhood of 7,000 miles per year. So his net year's savings, because of good roads, would range from \$35 to \$105.

As applied to state highway systems where considerable progress has been made in building high type pavements, the savings to motor car owners through lower car operating costs are enormous. Frank T. Sheets, chief engineer of the Illinois State Highway Department, points out that the state highway system is now saving Illinois motorists \$73,000,000 a year. Deducting from this sum the annual contributions of motorists to gasoline tolls (taxes) and license fees, a net saving of \$25,000,000 remains.

Further evidence of the tremendous savings, or earnings, of good roads is found in Iowa. Recently, Fred R. White, chief engineer of the Iowa State Highway Department, declared: "In eleven years we have built a new system of roads and they are paying for themselves in increased earnings. From a primary road system, which eleven years ago was 77 per cent unimproved and 90 per cent unsurfaced, we have progressed to a primary road system which is 90 per cent surfaced and only 7 per cent unimproved."

Since 1927 Iowa has hard surfaced 3,400 miles of roads and graveled 1,560 miles. As the roads were paved road usage increased materially. Even in lean 1931, receipts from motorists were \$1,500,000 greater than for 1930.

Missouri estimates her annual net road earnings at \$44,000,000.

But in addition to the savings brought motorists directly through lower car operating costs, there are the savings brought by the lowered maintenance costs which accompany high type pavements.

So in considering the earnings of highways we have the three means of return mentioned above: road earnings as expressed in income from motorists; road earnings as expressed in savings in car operation; road earnings as expressed in lower maintenance costs. They are cases in which new pavements would be self-liquidating from any one of these points alone. It will be found upon proper investigation that even a road which carries moderate traffic is usually justified when all three of these earning sources are considered.

The Emergency Relief and Construction Act stipulates that only self-liquidating projects which require no direct taxation can be built under the terms of the \$1,500,000,000 Federal loan plan. Certainly a utility which performs such an essential service as does the highway comes within this provision. The gasoline toll (tax) is just as much a road toll as were the fees collected in the olden days on private toll roads. The good road stimulates travel; it reduces car costs; it draws traffic from nearby inferior roads. The good road goes on and on earning dividends, dividends that build other good roads.

Cotton Reinforcement Inspected

After six years of service under general traffic conditions on stretches of South Carolina highways, cotton fabric used as bonding material has recently been inspected, according to the Cotton-Textile Institute, by Charles H. Moorefield, South Carolina highway engineer, who states that the fabric is still sound and apparently as strong as when it was installed. Furthermore, by holding the roadbed intact, where used, it has reduced the maintenance cost.

Mr. Moorefield, who was the pioneer in this use of cotton, applied it to road building in the belief that it would strengthen the surfacing. The results have fully justified his confidence. A recent examination of the first section installed, he reports, shows the fabric to be intact and still highly durable.

"The cotton fabric," he says, "unquestionably served to strengthen the surfacing and to reduce raveling. In this first section there is very little evidence of raveling, even at the extreme edge. By holding the roadbed intact, the maintenance cost is reduced and necessary retrenchment made less frequent."

The use of cotton fabric for road work is especially adaptable to what are classed as "top-soil" roads, those with a sand or gravel base and clay binder constituting the many miles of secondary highways throughout the country. The cotton material used is an open mesh fabric, 36 inches wide, weighing about 4½ ounces per yard. It is applied after the original road surface has been graded and lightly tarred. The fabric is put down while the tar is still sticky and later it is given a treatment with hot asphaltic oil. Sand or gravel is then applied as a top surfacing and the road is ready for traffic.

The fabric acts as a waterproof blanket as well as a binder. It holds the surfacing material in place, prevents corrugations and ruts, resists breakage by impact and thus tends to prevent formation of holes or "duck nests." The strength it imparts at the edges of the surfacing also resists the so-called "raveling."

South Carolina's use of cotton fabric in highway construction has been followed in a larger way by other southern states, notably Georgia, Texas and Louisiana.

Reconstruction Finance Corporation Technical Committee *Appointed by President Hoover*

Announcement has just been made of the appointment by President Herbert Hoover of the Special Technical Committee, referred to in Section 201 of the Emergency Relief and Construction Act as the Control Projects Board.

This committee, which will pass on the eligibility of construction projects for Reconstruction Finance Corporation aid, includes the following:

Charles David Marx, Chairman, Past President and Honorary Member, A. S. C. E.; Professor Emeritus of Civil Engineering, Leland Stanford University, Palo Alto, Calif.

John Herbert Gregory, Director, A. S. C. E. for Va. and Md., Member of N. E. W. W. A., A. W. W. A., Professor of Civil and Sanitary Engineering, Johns Hopkins University, Baltimore, Md.

John Lyle Harrington, Member A. S. C. E., Consulting Engineer, Harrington & Cortelyou, Kansas City, Missouri.

John S. Coleman, Past President, A. S. C. E., New Orleans, La.

Herbert George Moulton, Member A. S. C. E., 20 Pine St., New York.

Major General Lytle Brown, Member A. S. C. E., Chief of Engineers U. S. Army; ex-officio member.

Development of a national organization, with engineering representatives at strategic points throughout the country, will be initiated at once.

The appointment of the committee marks the last major step in preparing the Reconstruction Finance Corporation for extending financial aid to self-liquidating construction projects.

Tractor Speed and Its Effect on Daily Output

By H. H. HONNEN

Tractor Division, Allis-Chalmers Manufacturing Company

A VERY comprehensive report on "Efficiency Studies of Highway Operations" was given in the July issues of *ROADS AND STREETS*, page 289, by Mr. T. C. Thee of the United States Bureau of Public Roads. The studies of this report were based on an average tractor hauling speed of 3.40 miles per hour. Obviously if the speed of the tractors is increased, the daily output will be increased or the number of units necessary for efficient operation will be decreased.

For your convenience we are reproducing two charts that appeared in the July issue. The first chart shows the number of 7 cu. yd. units required for shovel grading. The second chart shows the number of 7 cu. yd. units required on an elevating grader job. By following the arrows you will note that there will be four 7 cu. yd. units required when the tractors average 3.4 miles per hour. The wagons being loaded in 140 seconds and the length of haul being 950 feet. Likewise the elevating grader needs three 7 cu. yd. units where the cut is approximately 150 feet long and the length of haul is around 400 feet.

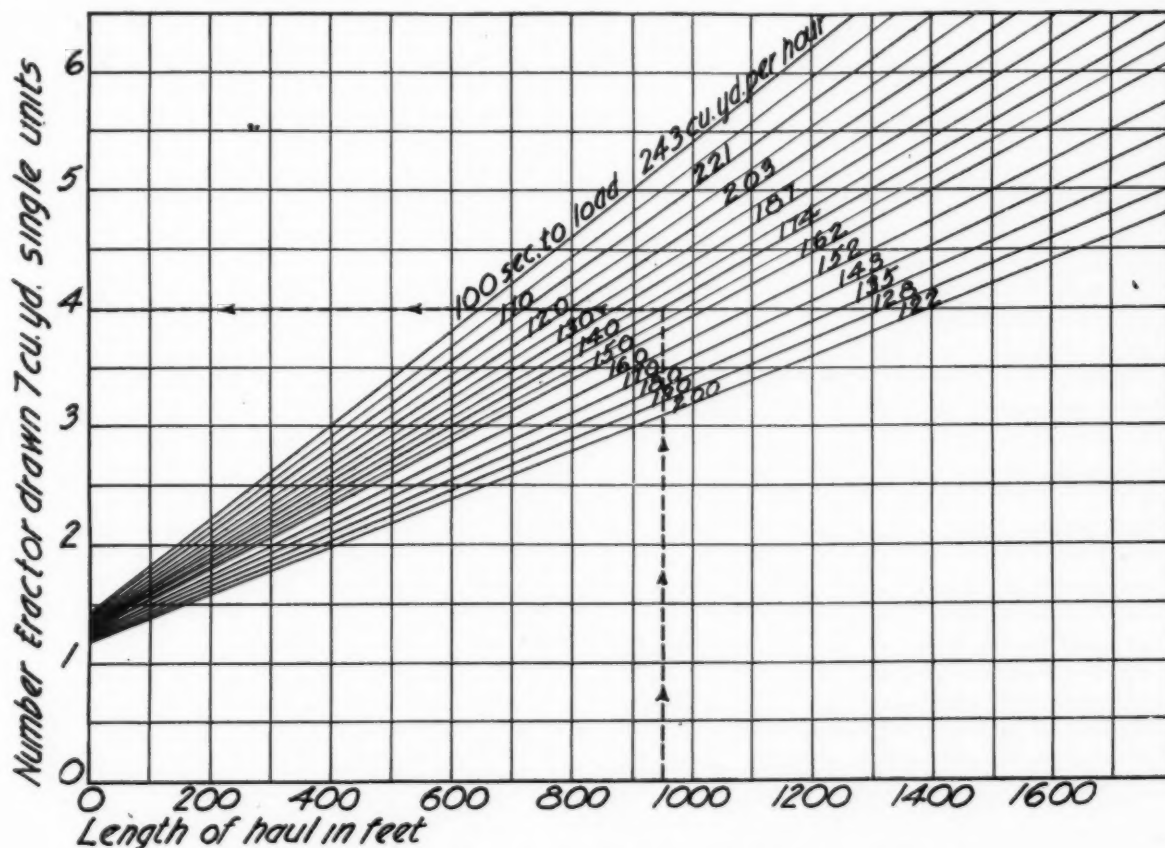
In order to show the advantage of higher speeds the

first table below has been worked up from Mr. Thee's Hauling Equation for speeds up to 6.5 miles per hour. A haul of 950 feet and a loading time of 140 seconds has been assumed as found in his studies.

| Tractor Speed Mi. per Hour | Tractor Speed Ft. per Second | Number 7 Cu. Yd. Units Required | Theoretical Number Required |
|----------------------------|------------------------------|---------------------------------|-----------------------------|
| 3.40 | 5.00 | 4 | 4.00 |
| 4.00 | 5.86 | 4 | 3.61 |
| 4.50 | 6.60 | 3 | 3.35 |
| 5.00 | 7.33 | 3 | 3.15 |
| 5.50 | 8.06 | 3 | 2.97 |
| 6.00 | 8.80 | 3 | 2.84 |
| 6.50 | 9.53 | 3 | 2.72 |

Assuming the haul length of 1500 feet with the same loading time of 140 seconds, the next table has been made.

| | | | |
|------|------|---|------|
| 3.40 | 5.00 | 6 | 5.56 |
| 4.00 | 5.86 | 5 | 4.96 |
| 4.50 | 6.60 | 5 | 4.54 |
| 5.00 | 7.33 | 4 | 4.20 |
| 5.50 | 8.06 | 4 | 3.96 |
| 6.00 | 8.80 | 4 | 3.73 |
| 6.50 | 9.53 | 4 | 3.55 |



*Fig. 1—Number of Single 7 Cu. Yd. Units Required for Shovel Grading

$$\text{Hauling Equation: } N = \frac{1}{t} \left(\frac{L}{2.5} + 42.1 \right) + 1$$

Where:

N = Number of Hauling Units Required for Haul, "L".
t = Time in Seconds to Load One 7 Cu. Yd. Unit.
L = Length of Haul in Feet.

Example: Enter Chart from Haul Length—Proceed Upward to Time Required to Load One 7 Cu. Yd. Unit, Or Its Equivalent in Yards Produced per Hour—Continue to Left Where Number Required Is Read.

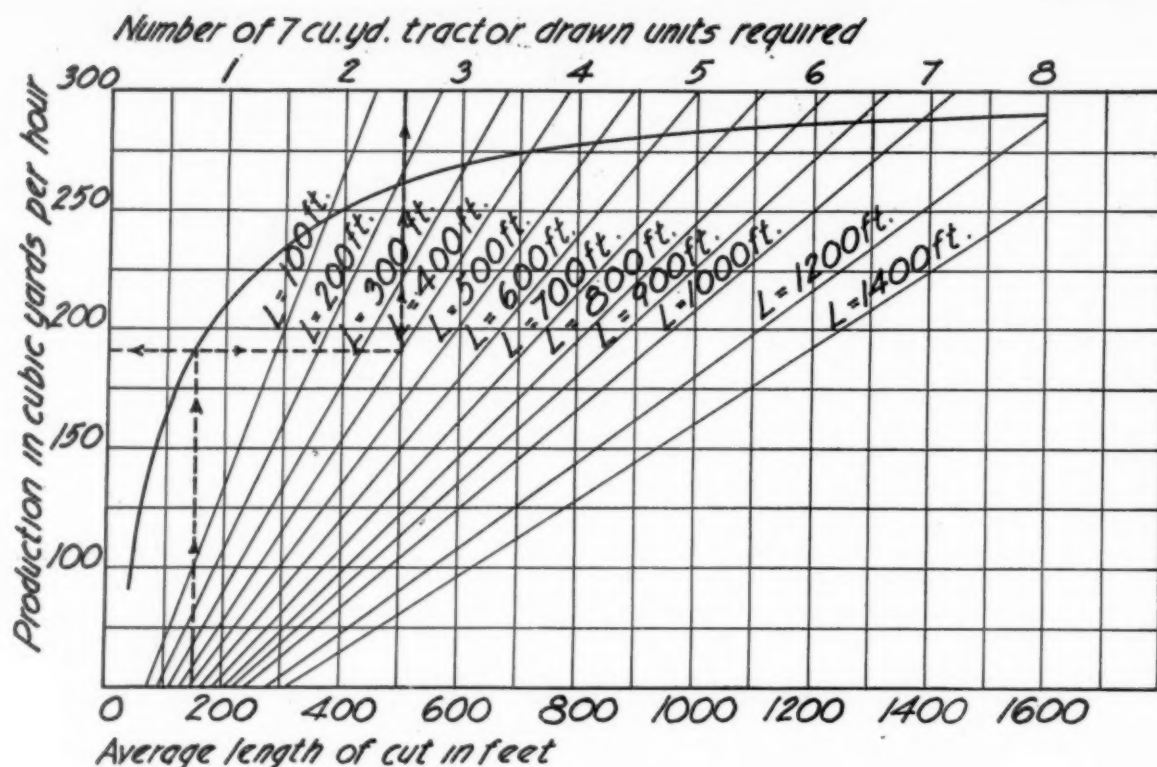


Fig. 2—Hauling Chart for Elevating Grader

$$\text{Equation: } N = \frac{\frac{L}{2.29} + 137.2}{\frac{7198.3}{C} + 78.0}$$

Where
 N = Number Hauling Units Required for Haul, "L."
 C = Average Length of Cut in Feet.
 L = Length of Haul in Feet.

Example: Enter Chart from Average Length of Cut—Proceed Upward to Curved Line—Then to Left for Production Per Hour—Return to Right to Length of Haul—Then Upwards Where Number Required Is Read.

The theoretical number of units have been included merely to show the true difference increased speed makes.

This saving in the number of 7 cu. yd. units required because of increased speed means a considerable saving in equipment and operating cost. For example, an operation where the tractors only average 3.4 miles per hour will require 4 units, while an outfit that uses tractors that will average better than 4.5 miles per hour will only require 3 units for the same daily yardage. The equipment cost the extra unit will amount to approximately \$7,000 and the operation and maintenance costs must be

added to this figure. The saving on a 1,500 foot haul is double this amount because the higher speed will displace two units.

The majority of road contracts in 1932 have been let on small projects so that it has been necessary for contractors to be very careful of their costs. In addition, strong competition has caused jobs to be let cheaper than ever before. Contractors must make a little profit to stay in business and speed is one of the answers to their problems.



This Improvement on the La Crosse-Sparta Road Eliminated a 16-Ft.-Wide Bridge and Reduced the Curvature to 6 Deg. The New Plate Girder Was Built by A. Beckman & Co. The 20-Ft. Bituminous Macadam Surface Was Built by La Crosse County Forces

Curiosity of Figures

More of It

- (a) $142857 \times 1 = 142857$
 $142857 \times 3 = 428571$
 $142857 \times 2 = 285714$
 $142857 \times 6 = 857142$
 $142857 \times 4 = 571428$
 $142857 \times 5 = 714285$
 $999999 \div 7 = 142857$
- (b) $12345679 \times 9 = 111,111,111$
 $12345679 \times 18 = 222,222,222$
 $12345679 \times 27 = 333,333,333$
 $12345679 \times 36 = 444,444,444$
 etc.

Contributed by Ray A. Giddings,
 Barberton, Ohio

STREET WORK A GOOD Investment

*Amount Invested Is Returned Many Times in
Benefits to Industry and Safety to
Motorists*

By HAMILTON M. WRIGHT

SO many cities in the United States have cut Public Works appropriations from their budgets or reduced them to a point that has brought street construction to a standstill that it is well to point out the advantages of making streets as a prosperity move.

First, employment is given to labor. Since no intrinsically valuable materials are used in building up and paving a street, the proportion going to labor ranges from eighty to ninety per cent of the total expenditures.

Second, the United States is confronted by an appalling list of motor vehicle deaths and accidents every year. They can be reduced by eliminating narrow roads, steep grades, traffic jams at crossings of highways by constructing overhead crossings and underpasses, to say nothing of repairing old streets at a cost now of 25 to 30 per cent below that of eighteen months ago and only about one-half that of five years ago.

Third, street construction is the best investment that can be made, returning its original cost to the community, with big interest to boot.

Despite the fine showing, street construction and repair has fallen alarmingly. In a report covering 161 cities and towns issued by the American Road Builders' Association it is shown that 79 towns and cities actually had no street construction listed for 1932. The annual appropriations for street work in these 161 cities fell from \$100,000,000 to \$60,000,000 despite the fact that 29 cities had actually increased their appropriations by a great margin in a heroic effort to give employment. A few cities comparatively are working on their streets. The rest throughout the United States are lagging.

While cities are laying down on the job, the states despite reduced appropriations are still constructing highways and in most cases without using tax money. In about one-fourth of the states, state highway funds are being allocated to help cities and towns with local roads. But in many of the others as in New York State there are restrictions as to the use of the state road funds. In New York State the motor fuel tax law provides that the receipts are to be used for the building and maintenance of state highways. No part of the funds are to be distributed or used for other unemployment relief purposes as, under statute, the state has no privilege to so use the money. Massachusetts and Rhode Island have switched six million and one million dollars, respectively, of their road funds to their cities and towns to be expended in local road building programs during coming months. Maine and Connecticut are also diverting a part of their state road funds to local road uses. Ohio has under way a program including the construction of 200 bridges; Wisconsin has inaugurated an extensive railroad grade elimination program as unemployment relief and the legislature has given cities and counties in-

creased aid in road building. Michigan has adopted a plan by which counties relieve townships of road liability, progressively over a five year period. Illinois is permitting Cook County to expend for relief purposes a considerable part of the gas toll (tax) money annually turned over to the county. Virginia has just made effective a plan to take over the construction and maintenance of all local roads, deferring the cost of the same by a gas toll.

One must not lose sight of the fact, however, that the communities in these and the few other forward looking states which are doing their best to provide employment in public works with the added help of state appropriations, are only a minority in relation to the rest of the country and that nation wide unemployment relief will continue to remain at a standstill until intelligent efforts result in widespread local public improvement funds widely programmed. Once raised, the question confronts city officials as to how to spend the fund to afford the greatest amount of work to the unemployed of the locality and at the same time do it the maximum amount of good. Unfortunately, reliable information on this essential point is all too scarce. America's experience in unemployment relief has been extremely limited in the past. Until the present time our national economic welfare has obviated the need for this work.

Federal government officials as well as numerous city and local officials who have found road building programs an effective scheme in creating employment for idle citizens advocate local highway construction as one of the soundest methods of applying relief funds at hand in various communities throughout the country. The



A New Jersey Project Nearing Completion

experience of cities where this plan has been put into operation has been, case history proves, far happier than that of communities where funds have been doled out-right to destitute citizens. Improved streets are a tangible result which augment the immediate and future prosperity of the city in addition to the more spiritual but no less important result of heightened morale of the jobless citizenry. A man makes a far better citizen and contributes far more to his community if he is enabled to work for his living instead of having it handed out to him while he remains idle.

One may question how many can be employed in this type of public work. Estimates of various street and highway contractors indicate that at least 80 per cent of the cost of street construction is distributed to labor. Half of this figure goes to labor actively engaged in making the street and the other half to labor involved in manufacturing and supplying the street materials. A large part of the remaining 20 per cent pays for the intrinsic cost of the materials such as broken rock, asphalt, sand, cement, freight charges, gasoline, etc. If the cost of a building or any other construction is similarly broken down, the labor cost will be found to constitute the largest factor in the price of the material.

Street construction puts men to work in quarries and rock crushing plants, in sand pits, on railroads, on trucks, power shovels, concrete mixers, on the street in spreading gravel with pick and shovel, and indirectly in machine shops fabricating all these machines and tools. It calls for the use of a large amount of fuel in the shape of wood, gasoline, and coal, all of which makes work for somebody. More important, it allows the use of a large amount of unskilled labor which can do this work efficiently providing it is expertly directed. The stagger system of employment is peculiarly applicable to street and road construction and by this method the amount of work to be done can be spread to a greater number of men than if an ordinary working day schedule were adopted.

Some cities which have taken up street construction as an unemployment relief measure have attempted to abolish machine work almost entirely, on the theory that more men would be employed. There is a fallacy here because as the experience of highway contractors has proved, work is so slowed down that no additional men can be used and costs mount out of proportion to value of the work. For example, about fifteen men are required on paving work when a mixer is used and no more men could be employed if mixing were done by hand. Fewer men would be employed on the job as a whole.

Street and highway construction, it is pointed out, is one of the few works that cannot be overdone. Work in mines and factories is limited by the demand for their output. But the frightful and constantly growing death and accident list involving occupants of motor vehicles and pedestrians due to inadequate highway construction demands that new roads be built sooner or later. Road construction costs today as already stated average 25 per cent lower than 18 months ago, and very much lower than five years ago. Keen competition among paving contractors and depression prices for labor and materials have greatly reduced paving costs.

Communities cannot allow their citizens to starve and neither can they afford to dole out large sums of money to destitute inhabitants over a long period of time without getting any return. On the other hand a program of public works including highway construction and street paving with intelligent direction of employment of men, hired by the city doing such work, will give jobs not only to the hungry and deserving men who do not

apply for charity until all their assets have vanished but will net the city a prosperity giving investment that will pay dividends for years to come.

Winter Bridge Construction in Ohio

January 22 marked the close of the greatest bridge game ever played in the State of Ohio and perhaps the country—it involved the expenditure of \$3,553,708.15. Because of the acute unemployment conditions in Ohio, Governor George White, early in the fall of 1931, set about the task of providing ways and means of relieving the labor situation.

A survey of all bridges on the State's system of 11,343 miles revealed the startling fact that there were many hundreds of bridges on the system too light to carry the legal maximum load and still hundreds more were classed as one-way structures. With this information the winter emergency relief bridge building program was conceived, the purpose of which was to provide work for thousand of worthy unemployed. Although winter construction is not uncommon in Ohio, no aggressive plan such as outlined had ever been attempted in the winter on either bridges or highways. The plan called for special specifications to insure first-class work, these being in addition to the general specifications covering highway construction. Heating of concrete materials were required as well as specifications designed for the protection of freshly poured concrete, curing and finishing. Timber structures likewise called for special attention as to treating, furnished from mills, cut to exact lengths, bored and shaped as per plans. These and many more details were only a part of the huge task of carrying the plan into effect. How this program was carried out is told by Earl V. Murray, Statistician Ohio State Highway Department in American Highway.

The program called for the construction of 350 bridges of concrete and steel and timber design. In order that the program get under way at the earliest possible moment, a corps of some 30 skilled bridge engineers, in addition to the regular bridge bureau's personnel, were started to design and prepare the plans for these bridges. As a result of the rapid development of this emergency program, the first bridge contract sale was held Nov. 6, and two or three lettings were held each month until Jan. 22, 1932, the last letting. By this time exactly 349 bridges had been placed under contract, at a total cost of \$3,553,708.15, and a task which seems almost formidable was finished.

What ordinarily would have been performed in three or four years, was accomplished in three months. The purpose of the program was two-fold—to build much needed bridges during the prevailing low prices and at the same time provide legitimate employment opportunities for worthy jobless men. Although it was found that winter construction was necessarily more expensive, the moderate cost of building materials offset the extra expense and, therefore, the undertaking was justified.

That the unemployed would have the opportunity of work, a non-partisan local relief committee was organized in each county in the state. Its duty was to investigate all applicants living within the county, to determine their need for employment.

The contractor was required to hire 85 per cent of his help from the list of men submitted to him by the relief committee. With but few exceptions, the entire scheme worked out to complete satisfaction of the state officials. Bridges on this emergency program were located in areas where unemployment conditions were most distressing in order that the work would benefit those communities in the most urgent need of help.

EDITORIALS

How a General Sales Tax Would Aid Highway Improvement

GASOLINE taxes are sales taxes that have been very effective in raising funds for highway improvement and maintenance. Diversions of gasoline taxes to other purposes became more frequent as the industrial depression became more severe. To add to this disturbing trend, the last Congress levied a 1 ct. gasoline tax which is estimated to yield nearly \$160,000,000 annually. Fortunately the federal government has appropriated a much greater sum than this for road work during the next fiscal year; but unfortunately a bad precedent has been established not only by levying an additional tax upon an already heavily taxed product, but by treating this tax as if it were a sales tax for general purposes instead of a sales tax for the specific purpose of highway improvement.

Among the various plans that have been suggested for preventing diversions of the gasoline tax to general uses, we have seen no suggestion that perhaps this can be accomplished most effectively by the adoption of a general sales tax on nearly all commodities. The result of a general sales tax would probably be to relieve gasoline from the burdensome 1 ct. federal tax. The state taxes on gasoline average nearly 3.5 ct. per gallon, which is about 20 per cent of the average retail price exclusive of the tax. The justification for so high a tax is that it is a toll paid for the use of the highways. An already high tax has been made higher without any such justification as to the additional 1 ct. per gallon. Had this additional 1 ct. been levied by the states and turned over to cities and towns for street improvement, few motorists would have objected. There is as good an economic reason why motorists should pay such a toll for city boulevard use as for rural highway use. And until such a toll is paid there is slight prospect that many cities will have smooth boulevards of adequate width.

A general sales tax, like that of Canada, is being urged by so many newspapers that a nearer approach to more equitable taxation by that route may occur through congressional action this winter. It seems to us that all persons interested in continued improvement in our highways would be wise to support a general sales tax.

Eating Dust on the Lincoln Highway

WEST of Omaha and east of Reno there are long dusty stretches of gravel surface on the Lincoln highway. While most of these gravel stretches are kept smooth by dragging, they are intolerably dusty. The pleasure of a transcontinental motor trip is sadly marred by such stretches. They exist also on the Santa Fe Trail. These are the two most frequently travelled roads to the Pacific Coast and to the scenic regions of the west. If there is any merit expressed in the slogan, "See America First," let us see to it that the be-goggled sightseers become as rare as bison.

The cost of making our four great transcontinental highways dustless will be nominal. This fact was brought forcibly home to the editor as he rode through Wyoming over scores of miles of gravel roads that have been surfaced with asphaltic oil.

In the May issue of Roads and Streets, there is an ex-

cellent description of the oiling of Wyoming roads, accompanied by cost data that bear out the above statement that the cost of securing dustless highways will be nominal. Penetration treatment has cost Wyoming as little as \$830, and not more than \$1,300 a mile. The average contract price of "plant-mix" was \$1.67 per ton in 1931, plus \$700 a mile for asphaltic oil. About 450 miles of "plant-mix" surface will be laid in 1932 in Wyoming. Mr. Stevison estimates that \$338 per mile per annum is saved by treating gravel roads in this manner. Hence at the same stroke that the motorist is relieved of his diet of dust, the taxpayer is relieved of a maintenance burden that far more than offsets the cost of the improvement in the course of a very few years.

In many instances the increased traffic that will follow such surfacing of gravel roads will justify the laying of heavier and more permanent pavements. Yet for hundreds of thousands of miles of country road the traffic will always be so light as to justify no greater expenditure per mile for dust elimination than is now being incurred in Wyoming.

We have more than 3,000,000 miles of roads in America, a scant 20 per cent of which is classed as being "surfaced." More than half the surfaced mileage is gravel or the like, from which great clouds of dust arise whenever a motor vehicle passes rapidly along. This leaves barely 10 per cent of road mileage that may be classed as dustless.

Will Rogers, who does most of his traveling by airplane, and has almost forgotten his dust-eating days, recently commented adversely upon federal appropriations for road work. Come out of the clouds, Will, and join some of us who have neither the price nor the desire to fly. We dust-eaters think that Uncle Sam made no mistake in appropriating that last \$120,000,000 as an emergency relief measure, even if the only relief we get is escape from eating the full peck of dust that all mortals are supposed to swallow.

Road Improvement Progress Compared With Increase in Motor-Vehicles

DURING the 15 years between 1913 and 1928, the number of motor cars and trucks became 20-fold. During the same period the number of miles of "surface roads" barely doubled. Yet there are many people who think that highway improvement has kept pace with the need for better roads.

In 1913 about 11 per cent of our roads were "surfaced." The percentage now is 23. In round numbers our total mileage of rural roads is 3,000,000. It sounds impressive to say that nearly 700,000 miles are now "surfaced," but when it is known that three-fourths of this "surfaced" mileage is gravel and sand-clay, a different face is put upon the matter.

It is true enough that a part of the gravel mileage has been surfaced with a bituminous mat, but this part is relatively small. We shall not be far from the truth if we say that barely 10 per cent of the 3,000,000 miles of rural roads can be classed as dustless.

In 1913 there were 1,258,062 motor vehicles using our roads and streets. In that year the total expenditure for

rural roads, including maintenance was about \$150 per motor vehicle. In 1928 the corresponding expenditure was \$58 per motor vehicle, there being then 24,493,124 motor vehicles. The present number of motor vehicles is 27,000,000, and the expenditures per vehicle for road improvement and maintenance have declined below the very modest \$58 of four years ago. In spite of the emergency relief appropriation of 120,000,000 by the federal government, road improvement and maintenance will probably not amount to \$55 per motor vehicle in 1933.

While this volume of road work has held up better than that of any other large industry, during the past three years, and while road construction bids fair to be the most active part of the construction field in 1933, it is important to realize that road improvement lags, and always has lagged, far behind public needs, if those needs are measured by the number of motor vehicles.

Almost every American family owns a motor car, and, what is more, uses the car a great deal even in times of greatest financial stress. If pleasure could be weighed, the pleasures of, and incident to, motoring would perhaps out-balance every other one in America. Judged by the purchases of gasoline and of tickets to the talkies, motor-dom and movieland outrank all other American "sports."

Time was—and not so long ago—when economists inveighed against the extravagance of owning a motor car. Now the same economists tell us that it would be a great blessing if some inventor would produce another device as popular as the automobile. For it is apparent, that only by devising more "luxuries" of great popular appeal, can all our workers be kept busy even five days a week. A hundred years ago our forefathers had all the necessities of life and a few luxuries. Ever since then industrial progress has consisted primarily in adding to the luxuries and in subtracting from the working hours enough time in which to enjoy them. So we no longer risk criticism when we frankly point out that Americans should be given a vastly greater mileage of dustless roads. Even if the added mileage of dustless roads had added nothing but pleasure in motoring, it would have been justified. But, curiously enough, the surfacing of roads has hitherto paid for itself in a very short time. Costs of hauling by trucks, and costs of maintenance of roads and of cars, have soon repaid the costs of road improvement in most instances. What other way of adding to more pleasure has also added to economic profit?

Reconstruction Finance Corporation Money Available for Toll Roads

SINCE it is the aim of the federal government to increase public works construction to the limit of available funds, and since the Reconstruction Finance Corporation has a one and a half billion dollars to lend for "self-liquidating" projects, serious consideration should be given to any scenic highway project that can be easily converted into a toll road. Although toll roads are not ordinarily desirable, these are not ordinary times.

There are many regions in America that would be visited by many fold over the number of tourists that now enter their portals, if smooth, dustless roads led to and through those regions. A short time ago the editor drove across the Yosemite Valley Park. Except for a short distance near the western portal, the road was intolerably rough and dusty and at times alarmingly narrow. For at least 50 miles it is the sort of road that the tourist who has travelled it will warn other tourists to avoid. Unfortunately this sort of tourist advice is applicable to hundreds of miles of scenic highways. Beautiful scenery, delightful camping spots, and attractive trout streams and lakes exist in scores of regions in

America, where "every prospect pleases and only the roads are vile."

The opportunity of a life-time now presents itself to state highway and county commissioners to secure federal funds with which to improve the roads that lead into and traverse these scenic and camping regions.

Authority must be secured to borrow federal money for toll road purposes, but the necessity of providing relief for the unemployed is and will be so urgent that there should be no great difficulty in obtaining authority to build certain toll roads. The same is true of toll bridges. As to the latter, see the first article in the August issue of *ROADS AND STREETS*, which tells about the toll bridges that the Kentucky Highway Commission has built and is building.

H. P. Gillette

Drive in the Lane

STRADDLERS are found in other places than politics. The most provoking type are the ones who straddle the center line of a two lane highway, when driving, or the lane dividing lines on wider highways.

The line marked down the center of paved highways is considered one of the most definite safety features of modern highways, and motorists in Minnesota who fail to keep to the right of it in accordance with the uniform traffic law are likely to get tickets from highway patrol officers which will require their appearance in court, instead of the warning that has been customary to the present, a recent highway bulletin reports.

Motorists who make a practice of straddling the center line invariably swing in, after having turned out to meet other vehicles, without looking to the rear and without giving a signal, highway patrolmen report. This results in many side-swiping accidents through cars that have been behind them moving up to pass just as the line-straddler moves to the center of the roadway again.

A car approaching an intersection and traveling in the center of the road causes opposing motorists to expect a left turn to be made, and the turning to the right by the straddler, instead of to the left, frequently furnishes the settings for a head-on collision.

Federal Funds Spur State Highway Work

Within 24 hours of the receipt of authoritative information as to the amount of funds allocated to Minnesota in connection with the recently enacted national unemployment relief program, Commissioner Babcock issued call for bids on a number of new improvement projects.

We believe this was the first response to the unemployment relief bill. It is a definite spur to state highway work.

V. J. Brown

Bad driving on good roads costs thousands of lives annually. There's no sense to it.

Most automobile accidents could be prevented if drivers were not so prone to make mad dashes for no place in particular.

County and Township Roads

A Section Devoted to the Interests of Those Responsible for Secondary Road Improvement



Township Road Near Creal Springs; One of the Roads Leading into the Fruit Country of the Ozark Foothills in Williamson County

Single Track Concrete Roads *In Illinois*

By E. M. FLEMING

Manager, Highways and Municipal Bureau, Portland Cement Association

BEFORE the enactment of the first state road bond issue law in Illinois, practically all road improvement activities were confined to counties and townships. This was due to the state aid road law which provided, among other things, for a county system of roads, designated after approval of the state highway commission, connecting the towns of the county and the state aid roads of adjoining counties.

During this period of early activity in road building, the counties and townships built many modern bridges and an appreciable mileage of single track concrete roads. After the passage of the first bond issue law and the establishment of a state bond issue system of roads some of the counties made little progress on their state aid (main county) system of roads until activities were revived two years ago when a law providing for state gas tax refunds to the counties was passed.

The building of roads by local authorities has resulted in 61 counties, of the 102 in the state, building over 875

miles of single track concrete roads. The oldest roads have been in use eighteen years with many of them fifteen years old. These roads, years after their construction, show how well or how poorly they serve as local roads. They are well scattered over the state, from east to west and north to south, serving practically all types of farming communities under many variable conditions of traffic, soil and climate.

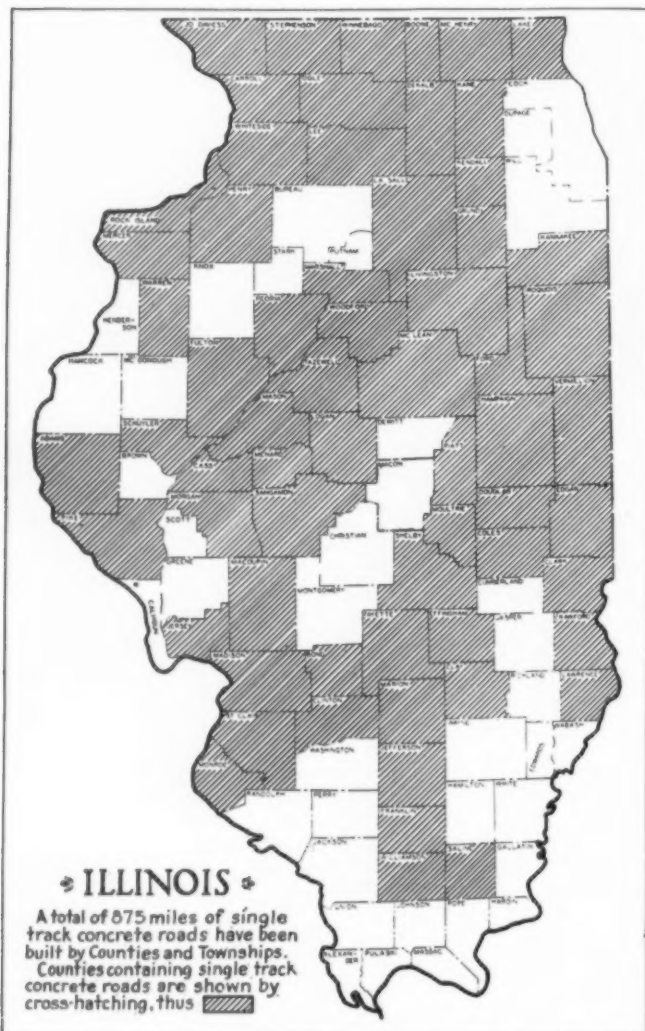
Perhaps the most striking lesson learned from these roads is the conservation of highway funds made possible by their use. As might be expected, some of the roads, built before the state bond issue system of roads was established, were on the main roads in each community and, as the state progressed with its building program, the single track roads have become a part of the state system.

A particularly valuable illustration of the early use of single track concrete roads is found in Jo Daviess County in northwestern Illinois. The hills are composed of

heavy clay that makes traveling very difficult in wet weather. As a result, the two largest towns in the county, Elizabeth and Galena, the latter the old home of General Grant, and both in valleys, wanted to improve their roads into town. Elizabeth had a particularly hard problem since the road leading into town was down a long, winding hill. It was almost impossible to drive up this hill in spring and many accidents occurred as a result of driving over the edge of the roadway at night.

In 1915, the outside traffic lane on this hill, about a

hit on the scheme of building single track concrete to let people get to the mines. The coal companies cooperated with the county or township and usually were able to get part of the expense allocated to the local road unit. Sometimes the improvement would be on a 50-50 basis or it might only extend to the local unit supplying the cement as happened in one case.

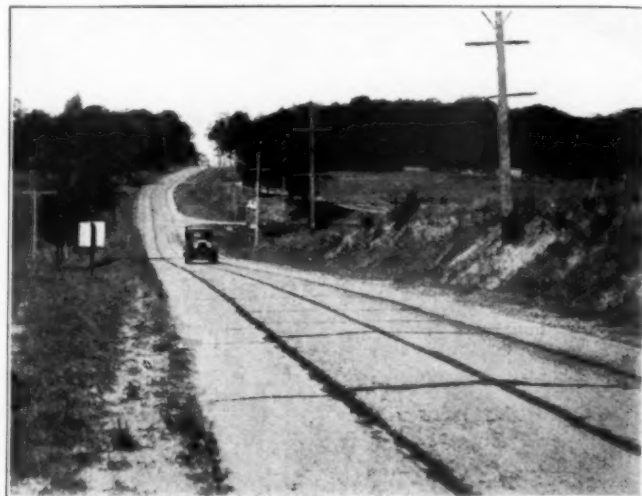


Map of Illinois Showing Counties with Single Track Roads in Them

mile long, was paved with concrete. Trouble with mud in the spring and fall was soon forgotten and it was noticed that accidents seldom occurred except during blinding storms. The lane of concrete served as a safety marker and drivers could always see the edge of the roadway.

This road served traffic, mostly of a local nature, until 1925 when the state took it over and widened it as a part of one of the main east and west transcontinental routes, U. S. 20. It now carries as high as 3,000 vehicles a day with many heavy truck and bus lines using the road, yet the original investment made in 1915 is still giving service. The refund of money to the county for the original road will permit it to build more roads.

In Peoria and Woodford counties, in a coal mining region, the single track road has solved the transportation problem for several local mines. Coal is purchased in the late fall and early winter when roads are at their worst. Several small companies had no possible rail outlet and



The Broadus Hill Road near Lacon Was Paved in the Center in 1915

An interesting example is found north of Peoria in Marshall County at Lacon. To the east of Lacon is the Broadus Hill road that, years ago, had a reputation far beyond the county for being a quagmire in the fall, winter, and spring. At times, it was impossible to haul loads over this road. It was even difficult to get the old buckboard through with a team of horses. Most people going to town over this road preferred to go horseback, and on a good horse.

The state aid law, previously mentioned, put an improved road within reach. It was decided to pave because it was known, from the tons of gravel already lost, that nothing else would do, and even the success of concrete seemed a little dubious. In 1915, the Broadus Hill was paved in the center for a width of nine feet. The road was watched with considerable interest the next spring, and the next. In 1925, ten years later, the state was ready to pave this road as a part of the bond issue system. The old 1915 slab was still in good condition and so two 4½-ft. strips were paved on each side.

To the southeast are found three counties, Champaign, Iroquois and Vermilion, each having a well developed sys-



Part of Iroquois County's System of over 145 Miles. The Earth Roadway Was Used for a Width of over 20 Feet Before Paving

tem of single track. These counties are average Illinois farming counties. In some areas, corn and hog raising predominate, dairying predominates in others and sweet corn is raised for canning in other localities. The sweet-corn is hauled to the single track with horses and then taken to the canneries by tractors pulling three or four wagons in a train.

It is the use of single track as exemplified in these three counties that illustrates the wisdom of far reaching plans of local road improvement. These counties decided on a system of local road improvement from ten to fifteen years ago and insisted that these plans be carried out. Some years, only a few miles could be built but slowly the entire scheme has worked out to the advantage of all, and local road taxes are being reduced.

One of the rather unusual facts brought out by the use of these roads has been that even quite heavy traffic can use the road most of the time. Champaign county is the home of the state university and is a mecca for football fans in the fall. It is not unusual for 500 vehicles

concrete roads has been developed to serve the coal fields and peach and apple orchards in the southeastern part of the county. The roads in the coal fields carry heavy coal trucking with only occasional shoulder maintenance being needed. In the fruit country, the development of orchards has followed road improvement. Rail transportation is none too good in this area since it is in the foothills of the Ozark Mountains and the old roads were often impassable in the fall. In a fruit country it is necessary to get the fruit marketed when it is ripe or the entire year's income is lost. With improvement by single track, the orchardists are assured of an outlet and a market when their fruit ripens, regardless of rains, and as a result, there has been a rapid development of orchards.

MISSISSIPPI POINTS *The Way*

THE belief is erroneous that the quickest and surest way of making state budgets balance, or of providing money for public relief, is by diverting road funds.

Mississippi, in need of cash as are most states, has proven it.

Failing incomes from regular tax sources made it necessary for Mississippi to find additional income. Mississippi weighed these two methods:

- (1) Raising the road toll (gas tax) and appropriating the extra funds for purposes unrelated to roads.
- (2) Establishing a general sales tax.

The first method was found wanting. Higher road tolls (gas taxes) and diversion would materially increase the cost of car operation and would reduce motor car usage. Such taxation would place an unfair burden on motorists as a class, and people of limited and moderate incomes in particular. Lessened road income would throw men out of jobs.

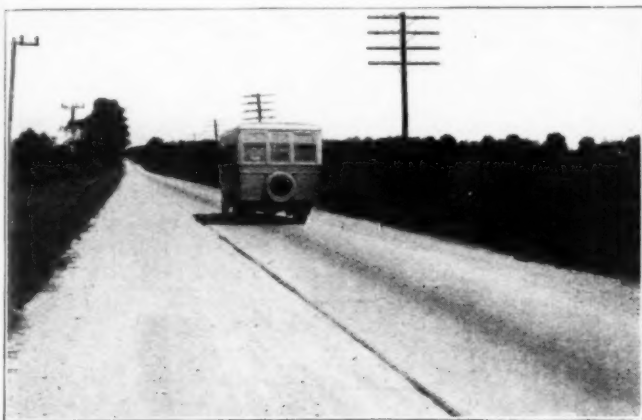
Then Mississippi gave consideration to the sales tax. Merchants and newspapers opposed it. They said there was no precedent for such a tax; that trade would be driven out of the states; that merchants would go bankrupt; that the cost of collecting a new and so general a tax would be prohibitive.

Nevertheless, the Mississippi legislature and Governor Conner had the temerity to break precedent. May 1 of this year a sales tax of two per cent on nearly all commodities went into effect. Returns for its first two months indicate that the tax will bring in a half million dollars a year more than the estimated \$2,000,000.

So far there has been no evidence that Mississippians have increased their out-of-state buying. Trade has gone along as usual. Retailer bankruptcies have not increased. The cost of collection is insignificant. Mississippi merely added a dozen men to the staff already collecting levies on tobacco, malt, and so on.

Early opponents of the general sales tax now admit that it is a completely satisfactory method of meeting the emergency; that the tax is equitable which road toll (gas tax) diversion could never be. In the raising of emergency funds Mississippians share in proportion to their spending.

A dozen other states, according to an Associated Press dispatch, are considering the adoption of the general sales tax. It is likely that the general sales tax will be accepted in preference to diverting road funds.



Vermilion County Uses Gravel Shoulders Although the Two Neighboring Counties of Iroquois and Champaign Find Earth Shoulders Entirely Satisfactory

per hour to use these single track roads, yet no accidents or inconveniences are reported, even during wet weather. It was also found that traffic on the old dirt road, before paving, kept it pretty well rutted up and dusty for a width of twenty to thirty feet. After paving one traffic lane the shoulders sod up to the edge of the pavement so as to make one wonder if the road is used at all.

Down in Williamson County, a system of single track



A Section of Road in Franklin County Built in 1917 That Serves the Coal Mines in the Same Way As Similar Roads in Williamson County to the South

BEFORE

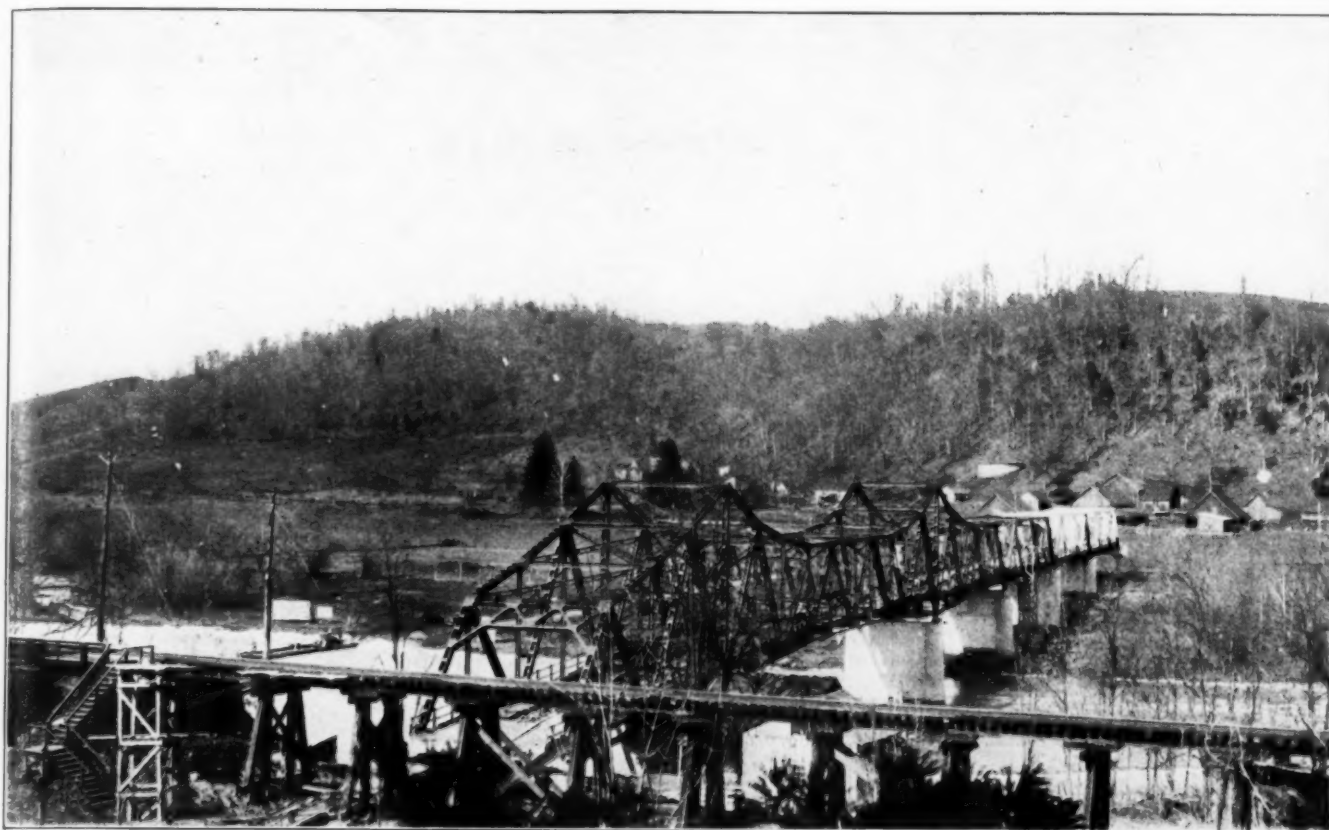


Many ferries served their purposes in the developmental stages of highway improvement



West from M. P. 0.25 on Route 327, Virginia

AFTER



But as soon as possible states built bridges near ferry sites. This one is at Jackson's Ferry on U. S. Route 121 over New River, Virginia



Surface Treatment Makes the Road Inviting

Motor Patrol

vs.

Horse Patrol

By LEON F. WALKER

Norwich University, Northfield, Vt.

MOST of the state highway departments and the larger counties throughout the country are now making use of motor-driven equipment for maintaining their gravel-surfaced roads. Many of the smaller counties, however, are slow to take advantage of this economical and efficient method of maintenance. Some small counties may feel that they are not justified in investing what seems like a large sum of money in machinery; they may feel that motor equipment is beyond their means. Some counties may hesitate about taking patrol jobs away from a half dozen or maybe a dozen men and putting in their place a high priced machine requiring only one man to operate it. There are many arguments which prevent counties from abandoning the old inefficient and costly horse patrol for the much more

keep it in serviceable condition. Where the traffic reaches the volume of around 200 vehicles per day, more frequent blading is necessary, and where the traffic exceeds 500 vehicles per day, daily blading is usually required. Any county which has as much as 75 miles of gravel surfaced roads which are carrying as many as 100 to 200 vehicles per day should find it advantageous to use motor equipment. The county may need only one machine, but this one machine can work wonders with the road surface and at the same time cut down maintenance expenses. The following table based on data obtained from the maintenance cost records of Crawford County, Illinois, during the period from 1925 to 1931 shows at a glance the difference in costs between maintenance with horse-drawn equipment and maintenance with motor-driven equipment.

COMPARATIVE COSTS OF BLADING GRAVEL ROADS WITH HORSE-DRAWN AND MOTOR-DRIVEN EQUIPMENT

Based on Maintenance Cost Records of Crawford County, Illinois—1925-1931.

| | Horse Drawn Patrol Grader | Horse Drawn Drag | Motor Grader | Seven Blade Main-tainer | Wheel Tractor |
|----------------------------------|---------------------------|------------------|--------------|-------------------------|---------------|
| Initial cost..... | \$180.00 | \$30.00 | \$3,000.00 | \$800.00 | \$1,600.00 |
| Useful life in days.. | 800 | 800 | 1,000 | 1,000 | 1,000 |
| Days operated each year | 200 | 200 | 200 | 200 | 200 |
| Life of blades in days | 24 | 24 | 12 | 60 | .. |
| Gals. gas per day.... | .. | .. | 19 | .. | 20 |
| Gals. oil per day..... | .. | .. | 0.5 | .. | 0.5 |
| Sets of tires per year | .. | .. | 0.4 | .. | 0.4 |
| Repairs during useful life | \$40.00 | \$8.00 | \$600.00 | \$200.00 | \$400.00 |

COST PER 10-HOUR DAY

| | | | | | |
|---------------------------------|--------|--------|--------|--------|--------|
| Depreciation | \$0.23 | \$0.04 | \$3.00 | \$0.80 | \$1.60 |
| Interest at 4%..... | .04 | .01 | .60 | .16 | .32 |
| Repairs | .05 | .01 | .60 | .20 | .40 |
| Operator or man and team | 5.00 | 5.00 | 5.00 | .. | 5.00 |
| Blades | .12 | .25 | .67 | .50 | .. |
| Gasoline @ 15c per gallon | .. | .. | 2.85 | .. | 3.00 |
| Oil @ 60c per gallon | .. | .. | .30 | .. | .30 |
| Tires | .. | .. | 1.50 | .. | 1.00 |

| | | | | | |
|------------------------|--------|--------|---------|---------|--|
| Total cost per day.. | \$5.44 | \$5.31 | \$14.52 | \$13.28 | |
| Miles traveled per day | 12 | 12 | 36 | 30 | |
| Number of trips.... | 4 | 4 | 2 | 2 | |
| Miles of road bladed. | 3 | 3 | 18 | 15 | |

| | | | | | |
|--|--------|--------|--------|--------|--|
| Total cost of blading one mile of road | \$1.83 | \$1.77 | \$0.81 | \$0.88 | |
|--|--------|--------|--------|--------|--|

It is safe to say that gravel roads can be bladed with motor patrols for less than half the cost of blading with horse patrols, and the results obtained on the road surface with the motor patrol are so far superior to the results obtained with the horse patrol that there can be no comparison. The economy of the motor-driven machine is due to its higher rate of speed and its greater cutting width, while its efficiency is due to its heavier weight and greater power. The light horse-drawn grader or drag can merely scrape the road surface, while the heavy motor grader has sufficient weight and power to plane off all of the irregularities in its path.

The county with as much as 75 miles of main travelled road can divide this mileage up into equal sections of a length suitable for one day's blading, and the motor grader can blade these sections in rotation, one each day. In this way the main roads of the county will be bladed more regularly, and much more efficiently and economically than by the use of horse patrols.

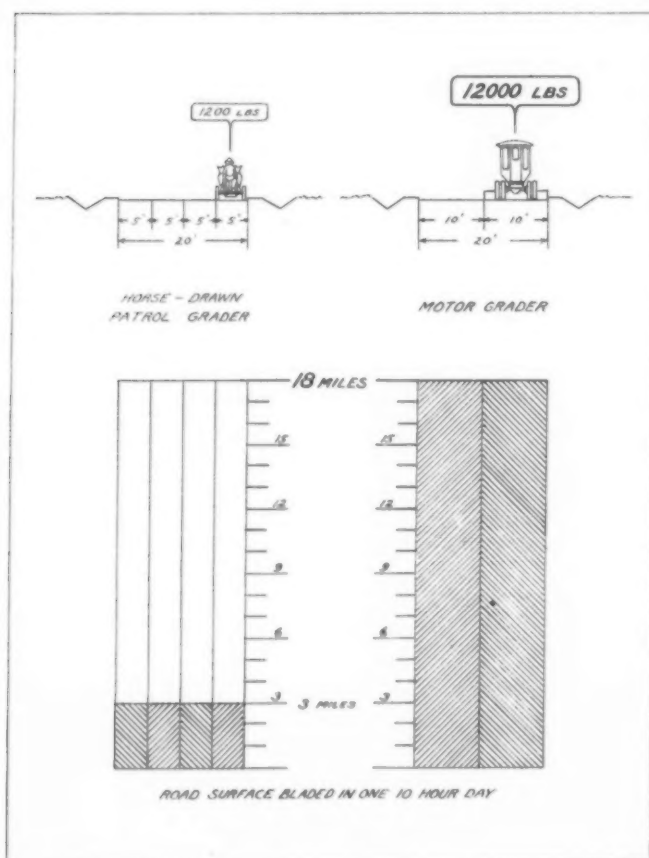


Diagram Showing the Superiority of the Motor Patrol Over the Horse Patrol in Weight, Cutting Width, and Distance Traveled

efficient and economical motor patrol. But whether it is "finances" or "politics" which stands in the way, there is no good reason why most counties cannot maintain their gravel roads more efficiently and for less money by using motor equipment.

It is generally agreed that any main travelled road, such as would be found on a county highway system, should have its surface bladed at least once a week to

SCANT YANT PLANT



Windrow device invented by the contractor to meet specifications as to location and shape of windrow

Exercised Contractor's Ingenuity

Plant-Mix Fine Aggregate Type Low-Cost

Road Built in Kansas with Bituminous Paver

THIRTY-TWO miles of bituminous paving just laid across Kiowa County, Kansas, presented an interesting combination of problems and solutions. The fact that the job involved the use of 200 mesh silica mixed in definite proportions with the aggregate, that all of the mixing was done with a traveling plant, together with a number of ingenious ideas which were devised by the contractor to meet requirements of the specifications combined to make a successful job that attracted considerable attention.

The new surface was laid over a sand-clay patrol road which had been regularly maintained. The mat was 26 ft. wide and about $1\frac{1}{4}$ in. average thickness.

Equipment Invented.—The first specification to test the ingenuity of the contracting organization was, "The equipment used in hauling and placing the mineral aggregates shall be so designed, constructed and operated that a windrow parallel to the center line of the highway and of a uniform cross-section throughout will be formed."

In order to conform with this specification with the greatest speed and economy, the contracting personnel decided to build a special "Windrow Machine." This machine which is shown in an accompanying photograph was designed and built on the job. Essentially it consisted of a chassis mounted on four wheels. Curved side plates gathered the materials which left the machine through an adjustable gate in the rear. The windrow machine straddled the windrow and was towed by a tractor. The trucks which hauled in the aggregate operated rapidly, due to the fact that only little care was necessary in spotting the loads when dumping. After the aggregate was placed originally in a series of piles, a blade moved the material to within 3 ft. of the center line of the road and the windrow machine was started. The adjustable gate was set for the required cross-section and the machine moved forward behind a tractor. When an excess of aggregate began to build up between the side plates, some of the material was loaded into a truck and dumped at a lean spot. Whenever the gate opening was not entirely filled, a truck dumped some material in front of the machine.

The next specification called for 12 per cent to 20

per cent of mineral filler in the form of silica or stone dust of such fineness as to pass a 200 mesh sieve. (The complete aggregate gradation will be given later.) Such a fine material would soon blow away if exposed for any length of time in most localities, and in the vicinity of this job the wind was blowing briskly almost constantly. It was decided that this 200 mesh material would have to be placed *inside* of the windrow. Many schemes were discussed and several devices were tried. The answer was found in what was called the "Silica Box" which is illustrated herewith. The silica box was mounted on skids, straddled the windrow and was also pulled by a tractor. The forward end of the box and a wide opening across the bottom, and the inside of the box was a hopper with sloping sides. The bottom point of the hopper projected down beyond the top of the front opening so that as the box moved forward the hop-



Silica box receives fine filler sand and covers 95 cu. yds. per mile in the windrow. Invented to meet demands in specifications

per point split the top of the windrow and the 200 mesh material in the box filled the opening in the windrow with the proper amount of silica. A floating V-scraper attached to the rear dragged along the top of the windrow and pulled the coarse aggregate back over the fines. The dust filler was supplied to the box by a truck which moved along side. In this way the filler was placed inside of the windrow in one continuous operation without ever being exposed.

Aggregate.—The initial windrow of aggregate ran about 480 cubic yards per mile. About 95 cubic yards of dust were added through the silica box. The function of the dust was to fill the very small voids and thus produce a dense and durable mixture. Theoretically this addition of 200 mesh material should not increase the volume of 480 cubic yards, however, in actual practice it was found that the volumetric measure was increased slightly. From 50 to 100 yards of the gravel that was bladed off of the sub-grade was added to each mile of aggregate.

A sieve analysis of the aggregate as delivered ahead of the traveling plant, omitting many of the screen sizes, is as follows:

| | |
|---|-------------------------|
| Weight per cubic foot, loose and dry..... | 106.8 pounds |
| Retained on $\frac{3}{4}$ in. mesh..... | 3 per cent |
| Retained on $\frac{3}{8}$ in. mesh..... | 11 per cent |
| Retained on No. 28 mesh..... | 59 per cent |
| Retained on No. 100 mesh..... | 84 per cent |
| Retained on No. 200 mesh..... | 88 per cent |
| Passing 200 mesh..... | 12 per cent-20 per cent |

One or two miles ahead of the traveling plant the windrow was spread out to a thickness of 3 or 4 in. to thoroughly dry the materials, and incidentally to mix the fines with the coarse. This operation was accomplished with a blade grader which later put the windrow back in shape.

Specifications required that the dry aggregate windrow be laid on a dry subgrade, and that the windrow of mixed bituminous material be laid on a primed base. Therefore, one side of the road was primed for a width of about 10 or 12 ft. to receive the mixed material from the traveling plant.

Prime Coat.—For temperatures above 60 degrees Kansas specifies asphaltic oil AO-1 for the penetration treatment or priming of the road to be paved. For this purpose a distributor was used. The following table gives the specifications of the AO-1 oil and the analysis of the oil used:

| PRIME COAT | | |
|---|----------------|----------|
| | Specifications | Analysis |
| Water and sediment, per cent, not more than | 2.000 | 0.2 |
| Specific gravity at 25°/25° C., not less than | 0.980 | 1.053 |
| Flash point, degs. C., not less than..... | 100 | 160 |
| Viscosity, Saybolt Furol at 122° F., in sec..... | 150-300 | 210 |
| 100 penetration asphalt content, per cent, not less than | 65 | 70.9 |
| Ductility of asphaltic residue (100 penetration) at 25° C., not less than.... | 100 | 100 |
| Bitumen soluble in carbon disulphide, per cent, not less than | 99.0 | 99.8 |
| Loss 50 grams, in 5 hours at 163° C., per cent, not more than..... | 8.0 | 4.8 |
| Bitumen insoluble in 86° API naphtha, per cent, not less than..... | 13 | 21.64 |

Kansas state specifications call for asphaltic oil AO-2 for the preparation of the bituminous mat—this is oil not to be used when the maximum temperature (weather) is below 60 degrees Fahrenheit.



Bituminous paver deposits mixed material in windrow on opposite side of road from aggregate windrow

The following table shows the specifications and the actual analysis of the oil used in the mix:

| BITUMINOUS CEMENT | | |
|--|----------------|----------|
| | Specifications | Analysis |
| Water and sediment, per cent, not more than | 2.000 | 0.3 |
| Specific gravity at 25°/25° C., not less than | 0.980 | 1.0665 |
| Flash point, degs. C., not less than.... | 100 | 152 |
| Viscosity, Saybolt Furol at 122° F., in sec..... | 600-900 | 725 |
| 100 penetration asphalt content, per cent, not less than..... | 75 | 82.4 |
| Ductility of asphaltic residue (100 penetration) at 25° C., not less than..... | 100 | 100 |
| Bitumen soluble in carbon disulphide, per cent, not less than..... | 99.0 | 99.85 |
| Loss 50 grams, in 5 hours at 163° C., per cent, not more than..... | 8 | 3.2 |
| Bitumen insoluble in 86° API naphtha, per cent, not less than..... | 15 | 33.29 |

The percentage of bitumen by weight to be used in the mix was determined by the New Mexico formula which is

$$P = (A \times .02) + (B \times .07) + (C \times .15) + (D \times .20)$$

P = percentage of oil by weight .

A = percentage retained on 48

B = percentage retained between 48 and 100

C = percentage retained between 100 and 200

D = percentage passing 200

$$.74 \times .02 + .10 \times .07 + .05 \times .15 + .11 \times .20 = .0148 + .007 + .0075 + .022 = .0513 \text{ or } 5.13 \text{ per cent oil by weight.}$$

Plant Operation.—A Barber-Greene bituminous paver was used for the proportioning and mixing. Since the Kiowa County job involved the use of 200 mesh materials, and since central plants have found it necessary to lengthen their mixing time in order to satisfactorily mix a bituminous concrete containing such a fine aggregate, many doubted the ability of a traveling plant to work with a satisfactory speed and produce a mixture that would consistently pass inspection.

The danger of "balling" was one of the reasons for skepticism. This "balling" may occur in two forms: namely, balls which are very rich, containing a great excess of bitumen, and balls that have a very lean core, in some cases even a dry core. However, no balling was detected on the entire job with the plant traveling at an average rate of 11 lineal feet per minute.

The paver is made up of two units—the loader and mixer. The loader picks up the aggregate, elevates, and discharges it in a 2½-yd. hopper on the mixer. The loader also pumps the bitumen from the shuttle tanks,

which operate between the tank cars and the paver, and stores the material in its own two storage supply tanks.

On this job the haul varied from 100 yd. to 5 miles. Approximately every 10 miles the source of bitumen supply was moved nearer the paver making 5 miles the maximum haul. Two supply tanks were used on the short hauls and three on the long trips. The material was heated in the tank cars, and normally no further heat was required, although the storage tanks on the paver were provided with heaters in case they were left filled over night.

The floor of the storage hopper is an apron feeder on which the aggregate is conveyed through an adjustable calibrated gate. The same shaft that drives the apron feeder drives a 3 in. pump which acts as a proportioning meter for the bitumen supply, thus providing a constant ratio of aggregate to bitumen, regardless of the speed of the engine. The loader speed is varied to

with a canvas housing for the same purpose. The operation of the machine was in the hands of two operators, one for the loader, and one for the mixer. A third man was used as a general helper, greasing the machines, and taking care of the hose that ran between the tank trucks and the loader. After the paver passed, the dry portion of the subgrade was primed and the windrow of mixed material was spread over the road width by blades. No mechanical finisher was used on this job.

Compaction was obtained by a light roller (3-4 tons) pulled by a truck or tractor. Due to the dense mix no keying or sealing was required and the roller was used principally to protect the surface against entrance of moisture before the mat had been compacted under traffic. There was sufficient traffic on Route 54 to consolidate the mat and give the road the appearance of sheet asphalt in 4 or 5 days.

Personnel.—The Yant Construction Company of Omaha, Nebraska, had the contract for this work which was a Federal Aid project running on U. S. route No. 54. Mr. Herman Haden, Superintendent, was in charge. A temporary headquarters was established at Greensburg, the approximate mid-point of the job.

Highways Reach Historical Points of Interest

The Minnesota state highway department has joined hands with the state historical society in marking hundreds of points which featured in one way or another in the state's early history. Many of these are of where settlements once flourished but are now long disappeared. Others of forts, havens of protection at some time but now at best but small piles of fallen stones; while others mark locations where wars among the Indian tribes took place; or where white people, pioneer settlers, made brave but futile stand against Indian attacks.

The markers are substantial steel plates, 3 by 5 ft. in dimension, into which the words of the inscriptions are deeply cut. Each marker consists of a caption in 4-in. letters, and a fifty word descriptive statement in 2-in. letters. Each marker bears the seal of the Minnesota Historical Society and the emblem of the Minnesota Highway department as vouchers for its authenticity. The historical society prepares the inscriptions and indicates the site for the markers, and the highway department erects them.

Placing of the markers has been made the occasion of interesting ceremony by numerous communities, and in some instances the land upon which they have been placed has been permanently preserved for usage.

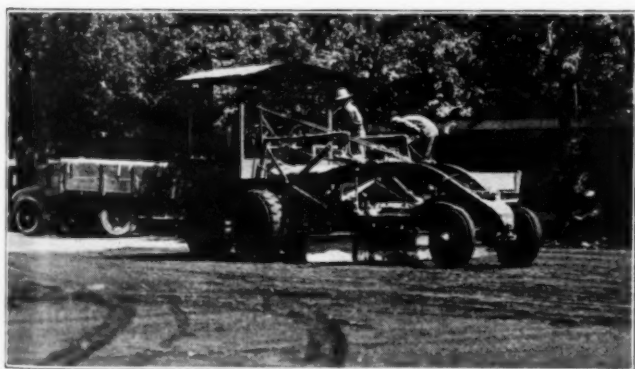
Other states have accomplished results similar to this type of commendable activity.



Finished mixed material ready to be spread in place by road machines

suit quantity of dry aggregate in the windrow without changing the mixing rate of proportion of the mix. It is self-propelled on its own tractor crawlers and tows the mixer unit which is mounted on free running crawlers. The continuous 80 blade twin pug mill proportions, coats, and mixes the aggregate and bitumen.

In order to comply with the specifications of having the dry windrow on the unprimed base and the mixed windrow on a primed base, the bituminous paver was equipped with a 24-in. by 10-ft. belt conveyor at the factory. This conveyor received the material from the



Road machine finishing the surface in city of Greensburg, Kansas

discharge end of the pug mill and carried it from 7 to 10 ft. to the side before discharging it into a windrow. The conveyor discharged to either side and could be raised to discharge into trucks if desired to operate as a central mixing plant.

To minimize the dust nuisance or the loss of the 200 mesh aggregate, the feeding end was enclosed in a canvas canopy that dragged along the windrow ahead of the machine and the joint between the discharge of the loader and the storage hopper of the mixer was fitted

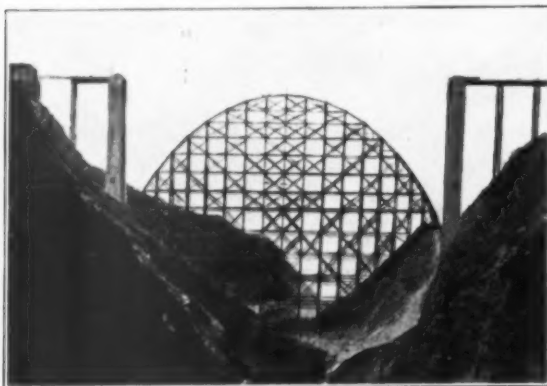


Hand Work on Bituminous Road Construction—Sweeping in Light Coat of 3/4-Inch Stone

Dead Load
Studies in Stresses and Strains
Designers' Dreams *Spanning the Gap*
Shear *Bridge* *Work* *Not* *Dental*



Bridge Over Staunton River at Altavista, Virginia, and Connecting Viaduct to Overhead Over Southern Railroad



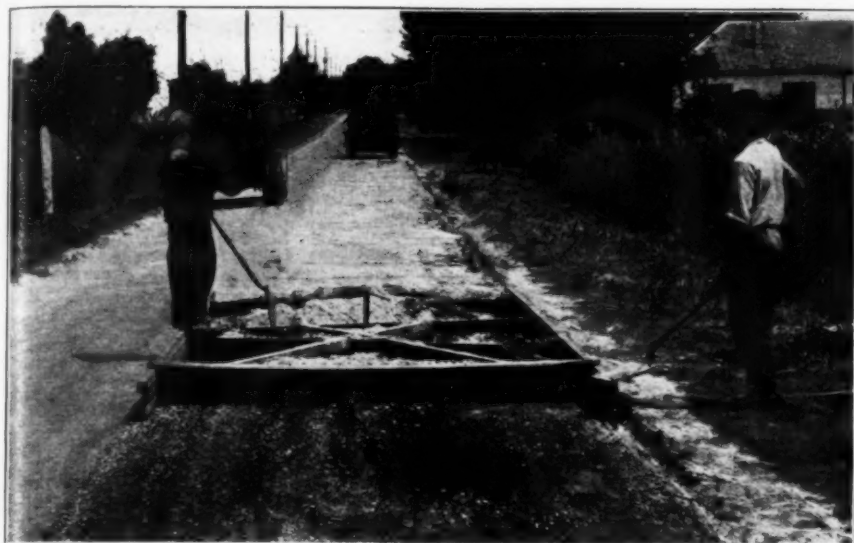
Left, Magnitude of Bixby Creek Arch Will Be Gotten by Noting Size of Men on Centering and Man Hanging to Block on High Line. Ten Miles South of Carmel, California.



Worm's Eye View of Approach to Bixby Creek Bridge on New Coast Route Between Carmel and San Luis Obispo, California



Bridge Over Shenandoah River on U. S. Route 50 at Berry's Ferry, Virginia
 All Pictures Courtesy State Highway Departments



Long Base Steel Drag After One Operation

Drag Surface Treatments

By A. R. TAYLOR

Tarmac Department, Koppers Products Company

UNDER modern conditions of high speed traffic, surface treating with cold application bituminous material has progressed from the oil sprinkling days of simple dust layers to a definite method of highway construction that furnishes smoother riding surfaces. This has not been accomplished, however, without noticeable improvement in the methods used. A highway official who does not familiarize himself with and use the improved methods keeps himself back in the old horse and buggy days.

Former Methods.—Surface treatment work is probably one of the oldest and most common methods employed for surfacing and maintaining old stone and gravel roads. Until within the past few years surface treating consisted of merely sweeping all loose dirt off the road surface by hand brooms or mechanical sweepers, applying one-half gallon of light cold application bitumen (8-18 specific viscosity at 40° C.) and covering with approximately 25 lb. of stone chips per square yard. Chips were spread by hand from one-half to one ton stock piles placed at intervals along the edge of the road. As traffic was allowed to use the road immediately a considerable quantity of partially coated cover material was whipped from the road surface to the shoulders, and vehicles were spattered with bitumen. These conditions were worse when the roads were retreated. Little attention was paid to the loss of cover material as it was excused on the grounds that the shoulders of the road were improved.

As time went on, more and more criticism was directed against the use of light cold application bitumens, particularly for retreatment work, due to this loss and displacement of the cover material under traffic and the length of time required for the bitumen to set up. Furthermore, hand methods of spreading were not economical and resulted in an uneven distribution of cover material.

Improved Methods.—Under modern practice it is realized that one of the most important features of building a surface treated highway is the proper preparation of the road surface before treatment. Thus the crown of a surface treated road should not be greater than one-quarter inch to the foot, and where an old high crowned macadam highway is being treated the crown should be reduced by scarifying and reshaping, or without disturbing the compacted macadam, by building a so-called wedge course which builds up the sides, tapering to the center and thus reducing the crown.

Improved Methods Result in Smoother Surfaces and Elimination of Former Objectionable Features

One of the first changes in surface treatment operations was more economical spreading of cover material. This was done by spreading by hand directly from trucks, later followed by dumping from the tail gate of trucks and by the use of mechanical spreaders. In addition to economy in the operation these changes also resulted in more even distribution of cover material, but did not greatly improve the riding quality of the finished surface. About the same time the practice of rolling the cover material became more general.

The next improvement was brought about in an effort to eliminate the objectionable features of surface treatment work. Some engineers tried dragging the surface, while others started using more viscous tars. Both were an improvement over former methods and materials, as the setting time was shortened and the amount of cover material whipped off the road surface by traffic was greatly reduced. A still more important result, from the public's point of view, was that both methods greatly reduced the spattering of bitumen over vehicles traveling over newly laid surfaces.

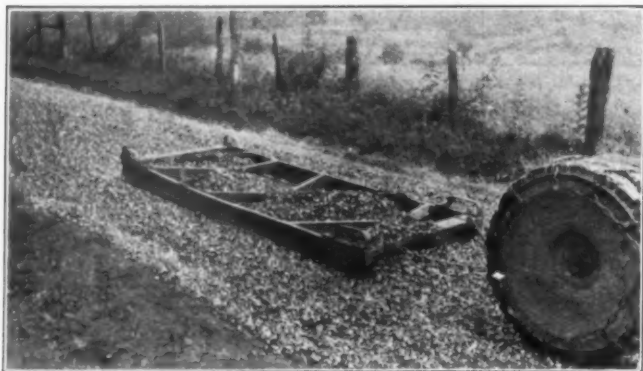
Dragging.—Dragging not only mixes the cover material with tar, but also pulls the mixture of the coated chips from the high spots of the road surface, depositing them in the depressions. Where the surface of the road is true and regular the cover material is uniformly distributed. Thus the smooth-riding qualities of the old surface is greatly improved making it safer for high speed traffic, whereas the former method of surface treatment simply followed the contour of the road without improving its riding qualities.

By mixing the aggregate with tar a thin uniform coating of bitumen is spread over the road surface. This thin coating helps to eliminate the formation of "fat" spots in the finished surface so prevalent in treatment not dragged. When dragging is omitted excess bitumen puddles in the depressions of the old surface.

Higher Viscosity Tars.—Where more viscous grades of tar were used, the bitumen set up quicker, held more cover material, and resulted in less whipping about of the cover material on the road surface. The specific viscosity limits of the tar were gradually increased, so that

today a considerable percentage of cold application tar used for surface treatment work has a specific viscosity at 50° C., ranging from 20 to 34, or 50 to 85 at 40° C.

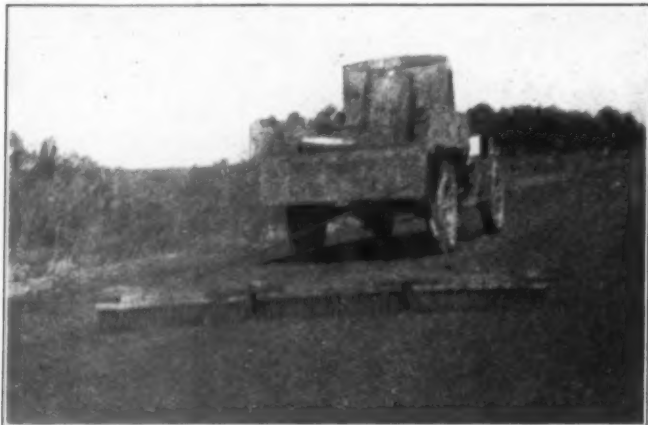
Drag Treatments.—The improvement in the quality of surface treatment work obtained from these methods, was responsible for the development of the drag treatment, which combines the advantages of both. It has done much to reduce the inconvenience to the travelling public, also giving them smooth riding skid-resistant surfaces.



The Long Base Drag Assures a Smoother Driving Surface on a New Hanover County Road in North Carolina

The drag treatment consists of an application of tar having a specific viscosity of 20-34 at 50° C. which is equivalent to 50-85 at 40° C., at the rate of $\frac{1}{4}$ to $\frac{6}{10}$ gallon, and 20-60 lb. of $\frac{1}{2}$ in. to $\frac{3}{4}$ in. aggregate, per square yard. When constructed to a loose depth of 1 in. it falls in the category of a road-mix surface, which requires a seal coat.

On light treatments not exceeding $\frac{1}{3}$ gallon of tar and 35-40 lb. of chips per square yard, the tar is first applied, and immediately covered with aggregate, dragged and rolled.



Broom Drag Distributing Cover Material

For heavier treatments, or when treating a high crowned road, it is advisable to spread part or all of the cover material before the application of tar. This insures a uniform distribution of binder over the road surface and prevents it running off the surface onto the shoulders of the road. It is particularly advantageous to use this method in extremely hot weather. A small amount of dust in the cover material is not objectionable as the drag will mix the tar and aggregate, at the same time lightly coating the surface of the old road.

Types of Drags.—Several types of drags have been used for cold application bituminous surface treatment work, such as the broom drag, two blade steel drag, long base drag, and "maintainer."

The first type of drag used on surface treatment work was the broom drag. It is rather simple in construction, usually consisting of rattan or steel brooms, fastened on a rectangular wooden frame, three feet or more in width, with a front and rear row of brooms about two feet apart. Where a wider drag is desired, two or more sections are fastened together by hinges so that the drag conforms to the contour of the road. In some few instances the broom drag has been designed similar to that



Two Blade Steel Drag Removes Only Minor Depressions on Chesterbrook Road, Fairfax County, Virginia

of the long base drag, with brooms replacing the steel blades.

A broom drag is particularly well adapted for dragging sand and pea gravel cover material and has been used extensively for this purpose in both the New England and Southern states. It is occasionally used with hot application bituminous materials where larger sized aggregate is used in order to uniformly distribute the cover material. As it is light and contains no blades it is not



Smoothing Gravel Road by Blading, Preparatory to Surface Treatment

adapted for smoothing up rough surfaces, as are the steel or wooden drags. The broom drag is more suitable for use on original treatments than the heavy long base drags, where rough surfaces are encountered, as it does not have the same tendency to cut through the bitumen into the base course.

The small two blade steel drag is similar in size and shape to the broom drag. The two blades are connected to a lever which permits their being adjusted at different angles, from 30° to 90°, to the road surface. This type drag was one of the first tried out. It mixes the aggregate with the binder, fills low depressions and scrapes new coated aggregate from the high spots in the surface. Having only two blades, which are spaced about two feet

apart, it does not mix the aggregate as thoroughly with the binder or remove the depressions as effectively as the long base drag. It may be used to advantage on very rough roads, preceding the use of the long base drag, and when the latter type is not available.

The long base drag is most effective for dragging cold application bituminous treatments. It consists of a wooden or steel rectangular frame, 12 to 18 feet long and from 5 to 8 feet wide, in which three or more blades are staggered at approximately 60° angles to the runners. At the end of the drag is a strike off blade which may be adjusted to any angle, but generally placed at a 90° angle. The blades are either steel or wood with tempered steel edges attached. This type drag is particularly well adapted for dragging retreatments as it thoroughly mixes the aggregate with the bituminous binder, removes all minor depressions and in addition cuts off high spots from the road surface, thus converting a rough road surface into one having smooth-riding qualities.

A maintainer having a long base and multiple blades, accomplishes the same results as obtained by a long base drag.

Conclusion.—The drag treatment is unexcelled for smoothing up rough, bituminous surfaces. For untreated stone, gravel, top soil, sand clay roads, etc., the surface should first be smoothed by blading or dragging, and then primed with a light viscosity (8-13 at 40° C.) tar. This should be followed with either a drag treatment, or a hot application tar in which case a light broom drag is used. Subsequent occasional low cost drag treatments maintain such surfaces at minimum expense.

Don't Fool with Gasoline Tax

In our continued fight against diversion of gasoline tolls, the following was sent out to all newspapers in Illinois:

"There are other people in this world besides motorists. The proposal to force Illinois motorists alone to finance the \$20,000,000 bond issue for unemployment relief by raising the gas tax from three to five cents is distinctly unfair and a violation of the principles of the Constitution."

This statement was made here today by H. P. Gillette, publisher of *ROADS AND STREETS*, and former assistant engineer of New York and chief engineer of the Washington railroad commission.

He urges that some other means be sought to provide needed money for the jobless which would bear on all citizens alike and which would not weigh heavily on any one industry or group of citizens.

"An increased gas tax would result in less highway usage," asserted Mr. Gillette. "Returns from the gas tax for the first six months of this year are lower by \$300,000 as compared with the same period of last year."

"An increase in the gas tax would further reduce the volume of motoring. That would mean less income for road construction by the state and counties. It would also cut into the appropriations now being made by the state for extension of state highways through towns and cities."

"In addition to paying the three-cent state tax, the Federal tax of one cent makes the total four cents a gallon. Then there are the state license fee, the property tax, and the other Federal taxes on oil, sales of motor vehicles, parts, accessories, tires and tubes. So the Illinois motorist is paying plenty of taxes right now without the proposed two-thirds increase in the gas levy."

"Unfair taxation of motorists would affect three industries important to the return of good business. They are the oil, automobile and road building industries

which if unhampered would expedite the return of better business conditions. These industries together normally employ about one out of every six workers. But they won't be able to place more men on their payrolls if road usage and car sales fall off.

"Mississippi has met the problem of obtaining state funds by facing it squarely. A general sales tax of two per cent applying to nearly all commodities has been in operation there since last May. The tax is not only bringing in the needed emergency funds but it is to enable Mississippi to reduce its state property tax by some fifty per cent, and perhaps eventually it will replace the property tax entirely."

"Pennsylvania has just placed a general sales tax of one per cent on the books. This tax will be used for six months only but it will provide the needed \$12,000,000 for the unemployed which was to have been lifted out of road funds."

"That's the sort of clear thinking action Illinois expects of the men she sends to Springfield," concluded Mr. Gillette.

Calculus Is a Valuable Tool

Calculus has been made much easier by the concept of curves to represent equations. If the student, on beginning the study of calculus, has a substantial foundation in algebra and analytical geometry, he should have no difficulty with the calculus, and will get a real "kick" out of the new ideas involved. Otherwise, calculus is very apt to prove a horrible nightmare for him, in which he dreams he is forced to learn the meaning of the meaningless.

As a matter of fact, the engineer who needs calculus is rare, and the one who can use it with facility, still rarer. It is a tool of considerable potential value, which is usually neglected and allowed to rust. Of course the engineer is indebted to it for many of his fundamental formulas. Perhaps it would be wise for the student to resolve to free his mind from the burden of remembering such formulas, and make it a practice to run through the development whenever he needs one. For many of them, the task calls for but a few minutes of time, and the plan would keep the calculus polished and ready for work.

Rene Descartes, 1596-1650, the French philosopher and mathematician invented analytical geometry and gave us the method of presenting equations graphically by rectangular or "cartesian" coordinates. All graphs, as they are called, for showing business cycles, statistics, equations, or any other information are based upon Descartes' invention of the x and y axes whose intersection is the zero or origin.

The tool is particularly useful to the engineer in the solution of maximum and minimum problems, a use which involves the easier part of the calculus.

Even if calculus had no use whatsoever in engineering practice, its study would be necessary for an understanding of the work in the last two years of college. It is particularly important that the student really understand the formulas derived by the calculus, even though he can use them with nothing more than arithmetic as an aid.—*Ohio Engineering Experiment Station Circular No. 27.*

NEW BOOKLET.—The American Road Builders' Association is preparing a "fact book" for the highway industry. The book will include information on the value of highways and pertinent data relative to the disastrous results of decreased highway construction and maintenance.

New York County Expenditures for 1931

(From the Low Bidder)

There is tabulated herewith a statement of expenditures on account of county highway work and bridges in the various counties of New York State for the year 1931. The figures cover construction and maintenance work performed and are confined to county work only, no funds used on the State system or for parkway work being included. It is also noted that these expenditures do not include any moneys spent on town highways or other routes under jurisdiction of the various town superintendents.

| County | Construction | Maintenance | Bridges | No. of Bridges Built | Total |
|--------------------|-----------------|-----------------|----------------------------|----------------------|-----------------|
| Albany | \$ 273,868.00 | \$ 111,819.00 | \$ 20,174.00 | 7 | \$ 405,861.00 |
| Allegany | 309,313.43 | 29,239.97 | 24,609.64 | 7 | 363,163.04 |
| Broome | 167,601.83 | 57,994.15 | 3,578.87 | 2 | 229,174.85 |
| Cattaraugus | 306,142.41 | 60,000.00 | 33,134.45 | 6 | 399,276.86 |
| Cayuga | 241,483.14 | 118,119.62 | 35,900.00 | 4 | 395,502.76 |
| Chautauqua | 574,600.00 | 107,500.00 | 70,000.00 | 9 | 752,100.00 |
| Chemung | 158,171.92 | 49,757.31 | 17,282.40 | 5 | 225,211.63 |
| Chenango | 235,879.14 | 55,543.29 | 6,422.56 | 3 | 297,844.99 |
| Clinton | 164,205.43 | 111,067.00 | 400.00 | 1 | 275,672.43 |
| Columbia | 302,241.80 | 54,913.07 | 59,010.41 | 9 | 416,165.28 |
| Cortland | 175,797.00 | 141,032.77 | 10,244.98 | 5 | 327,074.75 |
| Delaware | 418,146.61 | 90,000.00 | 41,739.35 | 11 | 549,885.96 |
| Dutchess | 397,308.01 | 121,521.52 | 7,706.14 | 2 | 526,535.67 |
| Erie | 1,263,665.42 | 986,819.34 | 290,714.69 | 31 | 2,541,199.45 |
| Essex | 148,437.48 | 104,597.56 | 20,045.84 | 4 | 273,080.88 |
| Franklin | 181,438.31 | 3,855.43 | 750.00 | 1 | 186,043.74 |
| Fulton | 92,899.13 | 43,089.71 | 6,104.13 | 3 | 142,092.97 |
| Genesee | 176,139.90 | 11,291.66 | 16,982.70 | 3 | 204,414.26 |
| Greene | 121,094.67 | 72,494.95 | 3,180.10 | 1 | 196,769.72 |
| Hamilton | 112,157.25 | 1,826.60 | 3,410.88 | 2 | 117,394.73 |
| Herkimer | 138,413.93 | 72,543.28 | 18,728.30 | 4 | 229,685.51 |
| Jefferson | 346,012.00 | 190,000.00 | 50,000.00 | 8-3 widened | 586,012.00 |
| Lewis | 165,775.39 | 66,324.13 | 6,000.00 | 1 | 238,099.52 |
| Livingston | 120,018.21 | 45,634.88 | 15,159.06 | 4 | 180,812.15 |
| Madison | 216,586.04 | 81,684.87 | 18,140.27 | 3 | 316,411.18 |
| Monroe | 613,262.26 | 77,470.22 | 2,778.43 | 1 | 693,510.91 |
| Montgomery | 122,103.45 | 70,000.00 | 28,523.15 | 4 | 220,626.60 |
| Nassau | 2,322,966.00 | | | .. | 2,322,966.00 |
| Niagara | 534,516.88 | 114,483.80 | 55,187.82 | 8 | 704,188.50 |
| Oneida | 422,332.57 | 134,996.66 | 4,800.00 | 2 | 562,129.23 |
| Onondaga | 977,492.10 | 82,885.12 | 12,730.90 | 2 | 1,073,108.12 |
| Ontario | 230,714.89 | 34,000.00 | 7,300.00 | 2 | 272,014.89 |
| Orange | 321,870.03 | 3,321.00 | 40,251.29 | 4 | 365,442.32 |
| Orleans | 187,500.00 | 20,000.00 | 6,700.00 | 2 | 214,200.00 |
| Oswego | 279,096.08 | 24,915.18 | 15,673.34 | 4 | 319,684.60 |
| Otsego | 362,644.33 | 81,317.63 | 25,518.89 | 5 | 469,480.85 |
| Putnam | 110,441.98 | Maint. by Towns | 12,500.00 | 1 | 122,941.98 |
| Rensselaer | 383,634.90 | 34,211.50 | 8,199.85 | 6 | 426,046.25 |
| Rockland | 120,265.61 | 16,156.69 | 15,457.09 | 2 | 151,457.09 |
| St. Lawrence | 464,890.88 | 34,057.02 | 27,338.83 | 1 | 526,286.73 |
| Saratoga | 186,798.11 | 129,099.62 | 15,360.59 | 5 | 331,258.32 |
| Schenectady | 359,431.16 | 35,500.00 | 3,529.36 | 2 | 398,460.52 |
| Schoharie | 178,235.20 | 35,607.53 | 35,995.74 | 6 | 249,838.47 |
| Schuyler | 62,101.75 | 38,539.21 | 25,105.51 | 6 | 125,746.47 |
| Seneca | 84,612.20 | 23,642.25 | | .. | 108,254.45 |
| Steuben | 307,560.56 | 197,843.34 | 18,698.56 | 11 | 524,102.46 |
| Suffolk | 406,680.81 | 7,000.00 | | .. | 413,680.81 |
| Sullivan | 204,862.48 | 123,237.82 | 10,691.03 | 5 | 338,791.33 |
| Tioga | 102,992.30 | 49,029.25 | Included in Costs of Roads | 5 | 152,021.55 |
| Tompkins | 187,657.98 | 36,634.38 | 12,376.20 | 4 | 236,668.56 |
| Ulster | 640,944.47 | 77,779.97 | 48,079.82 | 12 | 766,804.26 |
| Warren | 169,518.60 | 19,660.19 | 4,487.08 | 1 | 193,665.87 |
| Washington | 230,531.28 | 39,990.24 | 42,735.15 | 12 | 313,256.67 |
| Wayne | 248,485.02 | 44,000.00 | 5,057.65 | 4 | 297,542.67 |
| Westchester | 1,594,000.00 | 49,140.82 | 305,000.00 | 2 | 1,948,140.82 |
| Wyoming | 162,414.92 | 42,790.93 | | .. | 205,205.85 |
| Yates | 108,792.35 | 28,591.53 | | .. | 137,383.88 |
| Totals | \$19,496,747.60 | \$4,494,572.01 | \$1,569,495.05 | .. | \$25,560,814.66 |

The Road Builders' News

Keep Up Maintenance

Money now saved by failure to maintain city streets in response to the clamor of citizens for tax reduction represents a trivial economy in comparison with the enormous outlay that will be required to rebuild such thoroughfares later, it was pointed out in a statement issued today by Robert B. Brooks, president of the City Officials' Division of the American Road Builders' Association.

"Taxpayers in some municipalities, determined to reduce public expenditures, have gone so far as to insist upon elimination of funds sorely needed for maintenance of existing streets. In other places, even though money for street maintenance is available, powerful minority groups are demanding that it be not spent under present conditions.

"Every city should divide its street work into two distinct classes—first, maintenance, and second, new construction. What should be done toward furthering a new construction program is always a matter of careful consideration for both officials and taxpayers, but there never should be any question in the minds of either regarding the advisability of maintaining the streets they have.

"Every municipality has thousands and some millions of dollars invested in streets, and as a matter of common sense economy, every taxpayer should not only favor but insist upon these thoroughfares being kept up in proper condition in order to preserve this huge investment. Neglect of proper maintenance for a matter of only a few days can easily put streets into a condition which will involve expensive repairs or reconstruction much more costly than maintenance, this to say nothing of the inconvenience and inevitably higher cost of vehicle operation.

"It is to be hoped that taxpayers everywhere in their justifiable demands for economy in public expenditures will insist that our streets be maintained and the investment saved, seeing that streets are not only properly maintained for the remainder of this year, but that financial provisions are made for their adequate maintenance next year."

Motor Transport Has Advantages

Washington.—"Transportation by motor vehicles, busses and trucks over the public highways is a superior service. Rail and motor lines should be encouraged in the use of this instrumentality of commerce whenever such use will promote more efficient operation or improve the public service," said the Interstate Commerce Commission in a recent opinion.

Speed, flexibility, and completeness of service are among the outstanding service advantages of truck transportation, the Interstate Commerce Commission believes.

A summary of trucking facts prepared by the American Road Builders' Association



tion outlines the following interesting points:

1. Trucks can haul two pounds of freight with one pound of truck, whereas railroads require four pounds of freight car to haul one pound of "less than carload" freight.

2. The truck has most effectively supplanted rail traffic in those areas that can be served one or more times during the day.

3. Overnight delivery is a fertile field for truck use.

4. Shipments are received at a later hour than by railroads ordinarily and trucks make earlier morning deliveries.

5. Pick-up, transportation and delivery are included in the truck service.

6. Unusual requirements of an industry or a shipper and emergency and irregular shipments are handled through special efforts of truck operators.

7. Flexible schedules, no wasteful packing and suitable containers are features of truck service.

8. The average load of a rail box car is about 50 per cent capacity. It costs more to haul the car than its contents. Only about ten per cent of the life of a freight car is available for live haul.

9. Commodities handled economically by truck include milk, fruit, vegetables, live stock, poultry, eggs and less than carload shipments of other goods, eliminating delays, speeding deliveries, and taking advantage of daily price fluctuations to the advantage of the shipper.

10. On hauls under 200 miles trucks require less time in transit than railroads. Crates are often returned for a small fee.

11. Smaller inventories by merchants are made possible through frequent truck shipments.

Government Loans Will Aid Highways

"Federal loans to states for highway and other work now stagnating is a most desirable thing. As an aid to unemployment relief, to effect needed highway improvements, and to "keep the Government out of business" it seems most logical that the component parts of the governmental structure should receive federal assistance, is pointed out by T. H. Cutler, president of the American Road Builders' Association.

"The profitableness of highways has been proved not only by the consistent public demand for more and better roads, but also by the profit and loss accounting sheets for highways. While many of the benefits of improved roads are intangible, careful studies show that improved highways fitted

to traffic needs more than pay their maintenance costs and sinking fund charges through savings in highway transportation costs.

"Intangible benefits that are none the less real are evident to the most casual observer in sections traversed by good roads. These sections in nearly all cases show a better kept and more prosperous condition than exists in poor road sections.

"Better transportation by highway speeds up business and makes possible new business that could not exist without the improved roads," he concluded.

Highway and Building Congress

A joint meeting of more than ten national organizations representing every phase of highway and building activities will be incorporated in the Highway and Building Congress to be held in Detroit during the week of January 16, 1933. It is estimated that this gathering will attract 40,000 people, consisting of highway officials and engineers, contractors, manufacturers, architects, bonding companies, bankers and civic organizations, from all sections of the United States and many foreign countries.

The purpose of the Congress is to devise a coordinated program of future activities that will lead to the immediate improvement in national economic affairs as related to highways and building and, in addition, will prevent a repetition of conditions which have existed for the past three years.

The organizations participating in the Congress are: Construction League of the United States, American Road Builders' Association, Associated General Contractors of America, Truck Association Executives of America, The Asphalt Institute, National Crushed Stone Association, National Paving Brick Association, National Ready Mixed Concrete Association, National Sand and Gravel Association, and the Portland Cement Association.

Simultaneously with the Highway and Building Congress an exhibition of highway and building materials and equipment will be held at the Detroit Municipal Airport. The exhibits will cover the entire floor area of the gigantic airport hangar and will include all types of materials and equipment used in building and highway work. During the past year many new products have been developed in connection with highways. These new machines and devices will be on display for the benefit of those interested in the economical and efficient conduct of highway programs. The exhibition will afford an opportunity for the personal inspection of equipment and materials with regard to their workmanship, stability, adaptability, economy of operation and saving in road and building construction and maintenance.

One of the outstanding results of the Congress is expected to be the development

of a program of education designed to acquaint the public with the contribution of the construction industry to sustained national equilibrium. It will define the place of highway and other forms of construction in respect to improved transportation, industry, agriculture, education, and all other phases of national life.

Monday, Tuesday and Wednesday, January 16, 17 and 18, the individual participating organizations will hold their regular convention programs separately. Thursday a combined program will feature the highway program—its strategic position in the progress of the Nation, its relation to the economic and social life of every individual—its vital importance to education and industry—its benefits to agriculture—its significance in our transportation system—and its relation to the taxpayer.

Friday will be devoted to a program of building. Problems of the building industry for the future will be discussed, as well as the many problems confronting the industry in connection with the Relief Bill which was recently passed by Congress and which is now in the hands of the Reconstruction Finance Corporation. This meeting will be of particular interest to architects, contractors, bonding companies, bankers and material interests.

The speakers for the programs will be selected from the best known and most outstanding authorities in the country. The subjects to be covered are those of vital interest to every citizen, and the addresses will be so prepared that they will be read by everyone. In this manner the Highway and Building Congress will attract not only those particularly interested in the construction industry but those who believe in a sound prosperity for the future.

State Officials Commend County Maintenance Program

The American Road Builders' Association has started a campaign urging county officials to preserve their investment in highways by adequate maintenance.

State highway officials have been informed of this activity and their criticisms and suggestions invited. The following excerpts received from states show hearty endorsement of the campaign.

"I think this is a very good idea and agree with you that the only way to maintain our original investment in the construction of highways is to keep adequate maintenance on same. While it is necessary for us to retrench at the present time due to economic conditions, at the same time it is our plan to keep all of our highways maintained to a very high standard. You can depend on our state as an advocate of road conservation."

"We thoroughly agree with the principles outlined for your campaign. Maintenance of roads already constructed should be the last item to suffer curtailment to the extent of impairment. These roads should be kept at par value if possible."

"It would be a great calamity if the roads of the country are allowed to go down during this emergency and will cost many millions of dollars to restore them

to their former good condition when better times have come."

"In view of our limited funds, we are concentrating all of our efforts on maintenance at this time."

"We have had many consultations with county officials calling their attention to the need of maintenance and further that maintenance should be carried on throughout the entire year rather than periodically."

"Undoubtedly in many counties road work is sufficiently advanced so that some curtailment of construction can be made without danger, but I want to caution you against going too far. We must remember that our road and bridge taxes, whether they are vehicle and gas taxes or direct levies, are just a part of our vehicle operating cost. They are a part of our transportation bill, and not a part of the cost of government in the ordinary sense that taxes are used. I want to caution you especially against any cut in maintenance expenditures unless you have made a careful check of your road conditions. Any curtailment of maintenance which will result in impairment of the roads already constructed, or which will increase the cost of transportation of farm products, would be very short-sighted economy. I also want to caution you against any haphazard slash of your construction program. Under present conditions of agriculture and business generally, it is imperative that reductions in tax levies should be made wherever possible, so that the burden on the property owner is lessened as much as possible. But your road and bridge budget should be carefully studied so that you do not pile up future road repair bills or increase in transportation costs greater than the savings in taxes."

"With the steadily increasing traffic it is hardly safe to curtail maintenance unless this can be done by improved and more economical methods. Any curtailment of accomplishments in your maintenance work will be short-sighted economy. Failure to provide proper maintenance for your roads will in many cases result in a deterioration of these roads and necessitate much larger expenditures at some future time. It will also result in an increase in the cost of motor vehicle operation, and since the larger part of the traffic is local traffic, the bulk of this increase will be borne by the people of your own county."

This vast network of arteries of communication must be maintained in good working order or there may be a slump in public morale such as in past history has followed a breaking down in means of highway communication. We have been accustomed to rapid travel over smooth highways in safety and with comfort. It must be remembered that the 693,000 miles of surfaced country roads out of the 3,009,000 in the United States attract a large part of the motor vehicle travel. The 2,316,000 miles of unsurfaced roads by no means render such a superior service. These unsurfaced roads—about 80 per cent of the total mileage—are often impassable without proper maintenance.

The future management of the highways is in the hands of the public who are the "stockholders." If the roads have been worth building, they are worth taking care of through proper maintenance.

Highway Fact Book

The Association is working up a "Highway Fact Book" for general and popular use.

The purpose of the book is to furnish authentic information that may be used in the various educational and publicity campaigns that are now being waged in the interest of our highway system—and which are absolutely necessary if the highway and street programs of the country are to be maintained on a high plane. The book will be especially valuable in campaigns for the development of facts and figures in opposition to the divergence of gas tax and motor license funds to purposes other than highways—a movement which the industry must combat in nearly every state within the next few months.

You can greatly assist in this work by submitting material for consideration. Such material may be either in the form of text, chart or both and should preferably be so that each subject be treated on a single printed page. (Size 6x9.)

PROPOSED SUBJECTS TO BE COVERED IN "HIGHWAY FACT BOOK."

- 1—Foreword.
- 2—Utility of the Highway.
- 3—The Nation's Highway Business.
- 4—Why More Highways Are Needed.
- 5—Ultimate Highway Transportation System.
- 6—1930 Highway Balance Sheet.
- 7—Highways Are Self-Liquidating and Income Producing.
- 8—Highways Stimulate Business.
- 9—Labor Gets Greatest Share of Funds.
- 10—Employment on Federal and State Highway Work 1931.
- 11—Highway Transportation by Truck Is a Superior Service.
- 12—Trucks Pay Taxes Proportionate to Road Wear.
- 13—Highway Departments Are Good Customers of the Railroads.
- 14—Railroads Receive the Greater Percentage of the Highway Construction Dollar.
- 15—Highway Materials Transported by Railroads 1931.
- 16—Highways Aid the Railroads.
- 17—Gas Tax Becomes the Most Important Source of Income for State Highways.
- 18—Funds for Local Highways Increased by Transfers from State Gas Tax and Registration Fees.
- 19—Special Vehicle Taxes Responsible for Development of Primary Highway System.
- 20—Gas Tax and Registration Fees Have Become the Most Important Source of State and Local Highway Income.
- 21—Gas Tax Relieves Real Estate of Its Tax Burden.
- 22—Why Special Vehicle Taxes Should Be Used Exclusively for Road Purposes.
- 23—What the Vehicle Tax Investment in Highways Means to the Nation's Growth and Welfare.
- 24—Industries Adversely Affected by Curtailment of Highway Activity.
- 25—Maintenance Preserves the Highway Investment.

New Equipment and Materials

"Zero Pressure" Tire Developed

Following three years of experimental work, announcement has just been made of a new type of high traction tire known as the "Zero Pressure" and perfected to meet the needs of tractor service.

This announcement follows a grant of a patent covering this radical new development, issued to The B. F. Goodrich Company, Akron, Ohio, manufacturers.

Successful in road work during the long experimental period, the manufacturers believe that the "Zero Pressure" can be adapted to all kinds of work that a tractor is called upon to perform in a manner that has never before been possible with pneumatic or solid tire equipment.

It is called "Zero Pressure" because it has favorable cushioning qualities, yet has no air under pressure within the tire.

The tire is designed to provide a snow-shoe effect in loose or soft soil, or sand, having a tread which reflects readily under load and provides unusual tractive qualities. As the tire is not under air pressure, no penetrating obstacle can damage it or cause delay.

Bouncing is eliminated, the tire rides easily, will not damage pavements, requires no inflation, and allows the equipment to operate at greater efficiency. The tire has already been widely accepted on road construction machinery and in some types of agricultural work.

The tread is designed to give positive, sure-footed traction under all conditions with a minimum amount of tread wear. The development of the "Zero Pressure" tire was started at the request of some of the important tractor manufacturers who had asked a prominent wheel maker to evolve a wheel and tire that would perform satisfactorily in the sand as experienced in citrus grove cultivation.

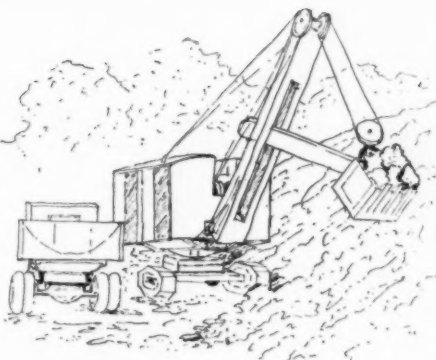
The Goodrich Company was requested to build a tire that required no servicing.

There were three primary requirements for the tire engineers to keep in mind as they started experimental work:

- (1) Positive traction.
- (2) Ability of the tire to ride on top and not dig in.
- (3) The tire must be troubleproof.

The results of this experimental work brought out a tire consisting of a rubber arch built on a slotted steel base for application to solid tire wheels. The piers of the arch are of sufficient size and rigidity to provide ample carrying capacity. The all-rubber arch is very flexible, and gives full tread contact.

Because it does not have any air under pressure this tire in service assumes a concave tread profile under load. In sand or soft soil, this results in packing the material under the center of the tire, producing a track for the tire to ride on and causing it to ride on top of the loose material rather than dig itself in.



Waukesha Introduces New Full-Power Engine

Waukesha Motor Company has announced an entirely new line of engines of increased efficiency, smoother operation and longer life.

These new engines, the product of eight years' research in both combustion chamber design and in metallurgy, are introduced as being H. L. Horning's interpretation of the basic Ricardo Principles carried to their logical development.

The new Waukesha Full-Power Engines are more conservatively rated than previous Waukesha products.

In the long and tedious investigation which brought about the development of the new Full Power line, H. L. Horning and his associates conducted continuous fuel research especially in conjunction with combustion chamber design, with a view to increasing engine efficiency, reducing engine size, and arriving at smoother operation.

In their research many designs were originated, tried and discarded, always to return to the basic Ricardo Principle, introduced in America by Waukesha nearly ten years ago.

Waukesha Alloy 221 is the special cylinder iron used, with hardness of 250-280 Brinell.

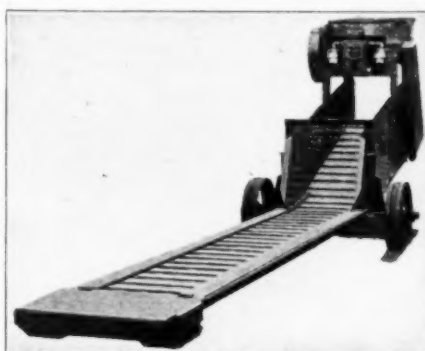
Inherent hardness and its close, uniform grain structure gives this iron a high resistance to abrasion and wear. It is a good conductor of heat, with the result that it readily withstands high heat stresses as well as mechanical abuse.

Another new iron alloy was developed by Waukesha for exhaust manifolds in the Full-Power line. Improvements in the manifold design itself make the method of attachment to the cylinders simple and accessible, and permit controlled heat to the intake with either up or down-draft carburetors.

The bearings are integral with the connecting rods and are cast from electrically controlled babbitt pots by centrifugal casting machines. Main bearings are made of the same material, bonded to steel backs fitted with precision into the crankcase bearing seats. The new Full-Power line ultimately will be complete for every service in which Waukesha engines are now used, and for which their standard Ricardo Head engines are built.

A New Fairfield Portable Troughed Belt Feeder

A further addition to the line of material handling equipment designed and built by The Fairfield Engineering Company, Marion, Ohio, is a low priced portable belt feeder intended especially to facilitate the speedy unloading of loose bulk materials such as sand, gravel and crushed stone, from hopper bottom cars.



Fairfield's New Portable Belt Feeder

The Fairfield portable troughed belt feeder receives the material as it drops from the hopper, carrying it for further distribution to a portable or stationary conveyor or elevator.

The feeder is 18 in. wide and 14 ft. long.

It is powered by either a 3 hp. electric motor or a 4½ hp. air cooled gasoline engine as desired.

The rubber belt is 18 in. wide, fitted with flat cleats on close centers. The belt edges are amply protected. Replaceable wear angles fitted to the frame of the feeder holds the belt in position at the curved section of the feeder.

The carriage wheels are mounted on spindles that can be lowered as much as 8 in. to compensate for inequalities in the level where the feeder is used.

The Eversman Automatic Grader and Land Leveler

For the construction and maintenance of airports, parks, athletic fields, golf courses, and for preparing fields for irrigation or on any job where it is necessary to secure accurate and fine leveling the Eversman Automatic Grader and Land Leveler has been developed.

The Eversman is of new design and handles dirt in a new way, taking all of the dirt through the machine instead of drifting it to the side. By this method a plane-table surface is produced by moving only the minimum required amount of dirt.

The grader blade on the Eversman is suspended on a movable sub-frame balanced with springs and connected to the wheels through an eccentric axle in such a way that when the wheels go on to a high place the blade lowers automatically. When the wheels find a low place the blade raises to release enough dirt to fill, leaving

enough extra to allow for settling. Both actions are positive and automatic. The front end rides on a "V" straight buster blade, the center on the wheels and the rear on a curved smoother blade which extends over the wheel tracks.

In addition to the advantages offered by this machine in automatically and economically producing a level surface, it is said to be an efficient dirtmover. A few pounds pressure applied to the long lever either by hand from the seat on the machine or from the tractor seat by a rope and pulley, holds center blade down to carry a full load any desired distance.



Eversman Automatic Grader and Land Leveler

The standard and special heavy models of Eversman machines have a capacity load of 1½ yards, the Junior model, 1 yard. The load is taken off smoothly and is deposited and spread smoothly.

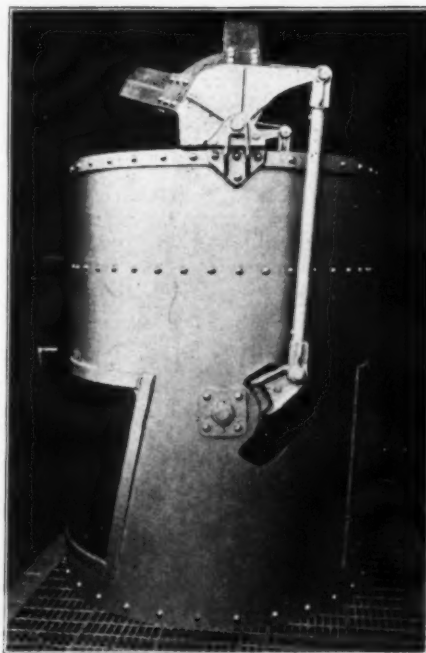
The distribution of the Eversman Automatic Grader and Land Leveler is now handled on the Pacific Coast and in the Hawaiian Islands by the American Tractor Equipemtn Co., 5319 Horton St., Oakland, Calif.

Blaw-Knox Improves Concrete Bucket

Blaw-Knox Company has developed a new form of Concrete Bucket, as shown in the illustration. This is rated as a 2-cubic yard bucket, but its actual capacity is 62 cubic feet. It will be evident that a bucket of this type fairly meets many requirements encountered in the placing of concrete on public works, or other construction, where large quantities of concrete are being used; where concrete is being placed subaqueously, a bucket of this character is almost indispensable.

The new 2-yard Blaw-Knox Concrete Bucket is of cylindrical form, consisting mainly of an inner and an outer shell. The outer shell is a true cylinder extended to form a base for supporting the bucket while it is being filled. The inner shell may be described as a flat cone, the discharge end of which is oval in shape. It requires two hook blocks for operation and is commonly termed a 2-line type. Its design includes many distinctive features as follows:

The discharge gate is operated by means of a twin bail, to which it is connected by thrust rods in such a manner that any movement of the twin bail is communicated directly to the gate. The twin bails are built rigidly together and pivoted at bracket connections on each side of the bucket, located slightly off center. The purpose of this off-center location is to insure the bail's being held rigidly against its stop, when the filled bucket is supported



Improved Blaw-Knox Concrete Bucket in the air, thus introducing a positive force tending to keep the gate in closed position

so that it will not respond freely to any pull exerted by the resistance to cable overhaulage on the dump hook block.

One of the principal advantages of this twin bail arrangement is that of keeping the two hook blocks well separated, thus avoiding their interfering one with the other.

The design is an inherently simple one, thus permitting the construction to be rugged and durable and one that can not easily be distorted.

While this 2-line type Concrete Bucket is not limited as to size, its most popular use lies in the range of larger buckets, from about two cubic yards up. While the principle of using two hook blocks for operating a bottom dump bucket is not entirely new, this design represents the first successful accomplishment of radial gate operation by two line control.

Southwark Develops Measuring Device

The new Scratch Extensometer weighs less than an ounce, is hardly larger than a teaspoon, may be attached to light as well as heavy structures, is recording and can be purchased for less than \$50. It has no competitor at a price much less than twenty times this figure. It records tension-compression strains and, also, when tension-compression strain is present, will record shear strain. It is necessary to make a special adaptation when pure shear strain alone is to be recorded.



Baldwin-Southwark Scratch Extensometer

It should be further explained that with strain known and with the modulus of elasticity known it is a very simple matter to evaluate stress. The lightness of the instrument, coupled with the low price, permits the application of many of these devices to a given structure for simultaneous determination of stresses.

Requests for Bulletin No. 40 will be promptly granted by Baldwin-Southwark Corporation, Philadelphia.

Unusual Dredge Made

A very interesting type of dredge with some unusual features has been ordered by the Mexican Government from Morris Machine Works and is now being built at their Baldwinsville, N. Y., plant, for widening and deepening the Grand Canal of the Valley of Mexico.

The Grand Canal is about 30 miles long, beginning as a sewer outlet where it is about 20 ft. deep, and ending in a tunnel where it is about 90 ft. deep. It is to be of trapezoidal section with about 12 ft. depth of water, the width at the water surface being about 26 ft. and at the bottom about 16 ft.

On account of the narrow width of the canal, it will not be possible to operate the dredge in the customary way; that is, by swinging it about one of the stern spuds. Instead, the cutter machinery will be designed to swing independently of the hull, while the hull will be held stationary by means of two side spuds and one rear spud. This rear spud will also be used as a kicking spud for advancing the dredge forward in the cut. With this arrangement of the cutter machinery it will be possible to make a cut 14 ft. deep, 30 ft. wide at the surface, and about 24 ft. wide at the bottom.

Loadmaster Now Available with Caterpillar Power

Bucyrus-Erie Company announces the new model CT Loadmaster powered by a Caterpillar tractor unit. This is in addition to other models of Loadmaster with McCormick-Deering or Case power and wheel



New Bucyrus-Erie Loadmaster Mounting

mounting or Trackson crawlers.

The model CT Loadmaster is a compact crane of 4,500 lb. lifting capacity. It fills the need for fast, mobile handling equipment which spots loads quickly. It has a full revolving boom. Besides lifting, swinging and carrying loads it can also be used for hauling trailers.

Standard booms are 10, 12, and 14 ft. in

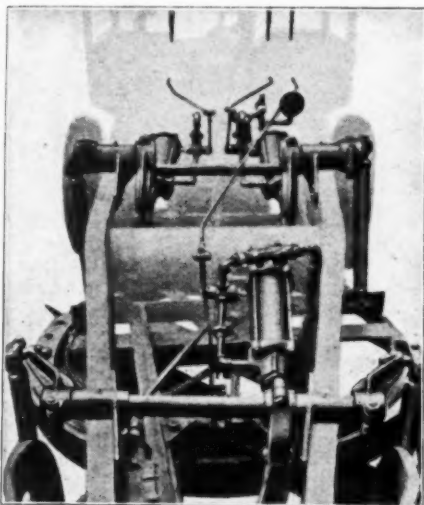
length, but longer booms are furnished when specified. Clearance is 9 ft. 1½ in. height, 6 ft. 1½ in. width. Special equipment available includes magnet, bulldozer, winch, clamshell, etc. If you are interested in additional information on Loadmaster write Bucyrus-Erie Company, Dept. L 17, South Milwaukee, Wis.

Galion Adds Hydraulic Feature

Hydraulic control provides a new advantage in motor grader operation. No wheels to spin. No cranks to turn. All adjustments of the moldboard and scarifier are now controlled by three easy moving levers, conveniently located, which reduce operation to a simple, effortless task.

Besides adding to the ease of operation, hydraulic control enables the adjustments to be made instantly and accurately.

Modern features of construction are embodied in the design of Galion motor graders, insuring the better performance and dependability. These include a main frame of 10-in. channel steel, pipe reinforced and welded throughout; sturdy



Plan View of Galion Hydraulic Motor Grader from Front

moldboard assembly which eliminates chattering; and ball and socket joints to lend easy movement to all moving parts.

A choice of three power units—McCormick-Deering, Cletrac, or Case—provides power to meet most every requirement or condition.

The blade and moldboard are reinforced throughout their length by heavy angle iron bolted on. The blade itself is of high carbon manganese steel.

Improved Sno Gard Posts

The American Steel and Wire Company announce their improved Sno Gard steel posts. Sno Gard steel posts are formed from special steel into a rounded back, flanged channel shaped post, and equipped with riveted hooks to support wood slat snow fencing. They are offered to the trade in various weights and all standard lengths, pointed to facilitate driving.

A special feature of this post is the rounded back and strong long riveted hooks. The hooks are riveted in an oval-

shaped hole and cannot turn over from vibration when driving. This is an exclusive feature found only in the Sno Gard post.

Anchor plates are considered unnecessary. Same can be furnished when desired at a slight additional cost.

These posts are supplied with hooks 5 in. apart so that snow fencing can be easily raised 5 in. or 10 in. off the ground and still provide a hook for each cable as the standard 4 ft. wood slat snow fencing has five horizontal cables, spaced 10 in. apart.

Special driving caps can be furnished, which will fit on all weights of Sno Gard posts so it is not necessary to buy more than one size cap. Driving caps are provided with a horizontal hole, so a rope or wire loop can be easily attached for convenience in the field.

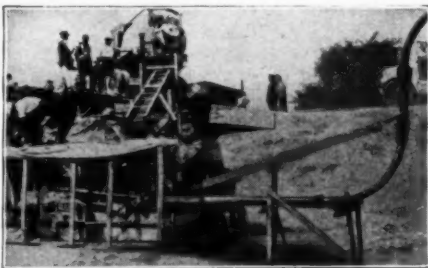
Pumpcrete Process Announced

For the first time in America, it is claimed, concrete was pumped to the forms in quantity when the Pumpcrete, owned by the Chain Belt Company, went into action on the Thirty-fifth Street Viaduct in Milwaukee, on August 11, 1932.

Pumpcrete is a concrete pump, developed in Europe for delivering concrete to the forms by direct pumping action, and apparently is the successful solution to a method of placement by direct pumping that has long interested concrete engineers.

The Milwaukee demonstration lasted twelve hours, during which the Pumpcrete handled 125 yards of mixed concrete to forms, including 1½ hours' idle time waiting for delivery.

The pump is of the piston type, gasoline or electric motor driven, and has a



Pumpcrete at Work

capacity of 15 to 20 yards of concrete per hour, and is portable. It will transport concrete 500 ft. horizontally, or up to 72 ft. vertically.

In the Milwaukee test, the concrete of the standard mix being used on the project was delivered in Moto-mixers to the hopper of the pump, the gasoline motor was started and the Pumpcrete started on a test that was to run through the full working day and well into the night.

Five-inch pipe was employed in the pipe line and the aggregates of relatively large size were moved through it, all day long. The pipe used was in 10-ft. lengths, equipped with quick couplings.

At one time the pump was stopped for half an hour while waiting for concrete. The Pumpcrete, however, took up its

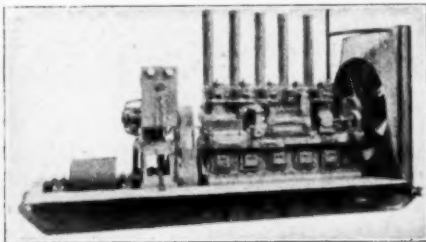
methodical turnover again, moving the mass through the pipe line.

The Pumpcrete is to be manufactured and distributed in America by the Chain Belt Company of Milwaukee, makers of Rex concrete mixers, pavers and Moto-mixers, who have purchased the American manufacturing rights from the German-Dutch combination who developed it and patented it throughout the world. Because this method of placement of concrete is so different, a demonstration is being arranged later in the fall for the construction, cement and other industries interested, as well as for public officials and engineers.

Contractor's Portable Power Unit Announced

The new Fairbanks-Morse power unit is a complete power plant in itself with radiator and water circulating pump, air starting equipment, fuel storage tank and a suitable generator in cases where electricity is required for lights or small motors. As these units are required to operate out in the open, they are usually provided with a suitable metal roof and either canvas or metal sides.

The power unit is a Diesel engine, a five-cylinder model. Starting air is supplied by means of a two-stage air cooled compressor, mounted above the camshaft housing on the operating side. It is driven from the camshaft gear through a small Twin disc clutch. A separate portable light plant and compressor are furnished for emergency air supply but ordinarily the auxiliary engine compressor unit would be supplied. Both engine and compressor are air cooled and the compressor is a duplicate of the one mounted on the engine.



Control Side of the New F-M Contractor's Portable Diesel Power Unit

Water circulation is obtained by means of a 1½-inch pump driven by a Flex-Mor belt from the crankshaft. The Modine radiator and eight blade 60-inch diameter fan used are designed to take care of full load cooling requirements. The fan is of the suction type turning at 530 rpm. and is driven from the crankshaft by four Flex-Mor belts. Air filters of the "American" type have been mounted on the exhaust side and deliver clean air to the cylinders.

Electricity for lights and motors is provided by a 25-kw., 250-volt direct current generator. The generator is mounted on a bracket over the clutch.

Domestic Adds to Family

The newest member of the "Domestic" family is a 2-in. self-priming pump of the

recirculating centrifugal type. Its capacity is 10,000 gal. per hr. at 10 ft. total head and 3,000 gal. per hr. at 50 ft. total head. It has a wide impeller of the closed type driven by a 2-hp. air-cooled engine.

It is mounted on a frame similar to either that of a wheelbarrow or a hand truck.

This pump embodies all the features of the larger sizes of their recirculating type, self-priming units and is equipped with the same type priming control regulator. With this control the pump recirculating system can be adjusted to assure maximum capacity and minimum priming time on any suction lift up to 25 ft.

For further information write to the Domestic Engine and Pump Co., Shippenburg, Pa.

New Allis-Chalmers Power Units

Three new stationary power units have been announced by the Allis-Chalmers Tractor Division, Milwaukee.

The Model E-50 is a four-cylinder unit with a $4\frac{3}{4}$ by $6\frac{1}{2}$ -in. engine; disc type clutch, as used in the Allis-Chalmers Model "35" tractor and steel belt pulley, 13 in. diameter by $8\frac{1}{2}$ in. wide. Its weight is 2,000 pounds.

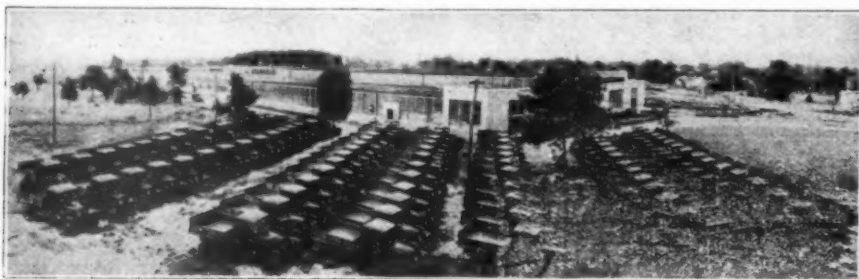
The Model E-60 is a four-cylinder unit, $5\frac{1}{4}$ in. by $6\frac{1}{2}$ in., oversize radiator, disc type clutch (as in the Allis-Chalmers "35" track-type tractor) and steel belt pulley, 10 in. diameter by $7\frac{1}{2}$ in. wide. It also weighs 2,000 pounds.

The Model U-40 is likewise a four-cylinder unit, but of lighter weight. Motor dimensions are $4\frac{1}{2}$ in. by 5 in., as in the Allis-Chalmers Model "U" tractor. The belt pulley is steel—10 in. in diameter by $7\frac{1}{2}$ in. wide. Weight 1,500 pounds.

Oil filter and air cleaner are standard equipment on all models. Each unit is equipped with a fuel tank, radiator, starting crank, magneto, carburetor, governor, air cleaner, clutch and belt pulley. Texrope drives can be used on any unit.

Hercules Dump Bodies

This part of a fleet of 100, $1\frac{1}{2}$ cu. yd. capacity, all steel, braced side rib, rub rail, tubeless, hydraulic hoist, Hercules dump bodies were recently delivered to one of the state highway departments for use on the highway system. This is claimed by the manufacturer to be the largest fleet of dump trucks for this work. Offices of the company are at Evansville, Indiana.



Fleet of Hercules Dump Bodies for Highway Work

Marmon-Herrington Develops All-Wheel Drive Trucks

A complete new line of all-wheel drive motor trucks, consisting of twelve models ranging in capacity from two to fifteen tons, is announced by the Marmon-Herrington Company, Inc., of Indianapolis.

This new line supplants the former offering of five models. Seven new models have been added, while the additional five have been improved and refined to make for greater efficiency in performing the tasks for which they are designed. Prices range from \$3,785 to \$17,500 f. o. b. factory, the lowest priced truck being the model TL-27-4 with a capacity of two to two and one-half tons, and the highest priced, the Model Th-330-6, a six-wheel-drive unit with a capacity of twelve to fifteen tons.

Since their introduction more than a



New Marmon-Herrington All-Wheel Drive Truck of 5 to 7 Ton Capacity

year ago Marmon-Herrington trucks claim to have met a long-felt need in the transportation field by combining the advantages of both truck and tractor for all types of heavy-duty work. The new line is engineered and built to do difficult heavy jobs and at the same time perform with speed on the highway. A. W. Herrington, formerly consultant of the U. S. Army, and president of the company, is the designer of the new line.

Outstanding features of the new line include the exclusive and patented front axle and front steering arrangement design, the equipping of all trucks with both standard and auxiliary transmissions giving as many as twelve speeds forward and four reverse, the strategic application of power giving the advantages of all-wheel drive traction, and an ease of handling and control.

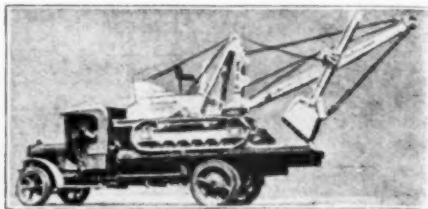
Bearcat Shovel Works Announces 3/8-Yd. Shovel

The Bear Cat Jr., a new $\frac{3}{8}$ -yd. convertible shovel, which is light enough to

mount and transport on a heavy duty motor truck, is announced by The Bearcat Shovel Works, a division of The Byers Machine Company, Ravenna, Ohio.

It sells for considerably less than any other shovel in the Byers' line, and is the result of this company's 50 years of experience in building excavating and material handling equipment.

The Bear Cat Jr. weighs $6\frac{1}{2}$ tons complete as a shovel. This light total weight is practical chiefly because of the balance of machinery which eliminates all dead counterweight, its extremely simple construction which allows all parts to be amply rugged, and its freedom from crawler mechanism beneath the machinery deck.



Bear Cat Jr. Transported by Truck

All operations of traveling, steering from both crawlers, swinging, independent crowding and hoisting are accomplished through only three operating shaft assemblies on the fully enclosed machinery deck. Even the travel shaft is located on the machinery deck; there are no shafts below the main frame. A 3 speed transmission between the motor and take-off gear provides 3 travel speeds and 2 operating speeds, for ordinary or light digging. The gear driven swinger can be positively locked to prevent swinging while traveling. All machinery is protected by an automobile type of hood enclosure and motor hood can be locked to prevent theft of gasoline and accessories. Motor is a 4-cylinder slow speed industrial type developing 30 hp. It uses only 10 gallons of gas per day in steady digging.

The purpose behind the development of the Bear Cat Jr. was to produce a dependable shovel and crane, incorporating the latest engineering developments and efficiencies, and also having a lower purchase price, lower operating costs and lower maintenance costs than ever before built into a machine of this type.

Its special design and construction features make it particularly adaptable to road maintenance, loading and unloading operations, basement excavation, gravel and clay bank work, trenching, back filling and light hook block jobs.

Because the Bear Cat Jr. sells for much less than even a heavy duty dump truck its price comes within the purse of many contractors, counties, townships and municipalities who could not before afford to purchase new heavy equipment.

A new 24 page, illustrated booklet, "How to Dig Dirt at Lower Cost," describes this machine and shows many of the ways to use it. Free copies are available by writing to The Bearcat Shovel Works, Ravenna, Ohio.